

(56)

References Cited

U.S. PATENT DOCUMENTS

5,135,552 A 8/1992 Weistra 55/337
 5,159,738 A 11/1992 Sunagawa et al. 15/326
 5,233,682 A 8/1993 Abe et al. 395/61
 5,251,358 A 10/1993 Moro et al. 15/319
 5,265,305 A 11/1993 Kraft et al. 15/319
 5,323,483 A 6/1994 Baeg 288/811
 5,542,146 A 8/1996 Hoekstra et al. 15/319
 6,192,550 B1 2/2001 Hamada et al.
 6,290,752 B1 9/2001 Koller et al.
 6,460,217 B2 10/2002 Fukushima et al. 15/346
 6,572,668 B1* 6/2003 An et al. 55/428
 6,589,306 B2* 7/2003 Ronning et al. 55/349
 6,625,845 B2 9/2003 Matsumoto et al. 15/353
 6,689,225 B2 2/2004 Illingworth 134/21
 6,694,917 B1 2/2004 Wang 119/51.11
 6,735,816 B2 5/2004 Oh et al. 15/353
 6,757,933 B2 7/2004 Oh et al. 15/353
 6,779,229 B2 8/2004 Lee et al. 15/329
 6,782,584 B2 8/2004 Choi 15/352
 6,922,868 B1 8/2005 Jeong 15/353
 7,028,369 B2 4/2006 Park et al. 15/353
 7,152,276 B2 12/2006 Jin et al. 15/352
 7,160,347 B2* 1/2007 David et al. 55/337
 7,171,725 B2 2/2007 Sjoberg et al.
 7,351,269 B2 4/2008 Yau 55/297
 7,475,449 B2 1/2009 Lee 15/326
 7,481,868 B2 1/2009 Lee et al. 95/273
 7,547,340 B2 6/2009 Park 55/429
 7,582,128 B2 9/2009 Hwang et al. 55/337
 7,601,188 B2 10/2009 Hwang et al. 55/343
 7,608,123 B2 10/2009 Pineschi 55/429
 7,640,625 B2 1/2010 Oh et al. 15/352
 7,644,469 B2 1/2010 Beers et al. 15/319
 7,647,672 B2 1/2010 Nam et al. 15/352
 7,704,290 B2 4/2010 Oh 55/295
 7,749,295 B2 7/2010 Hwang et al. 55/428
 7,770,253 B2 8/2010 Ha et al. 15/319
 7,785,381 B2 8/2010 Oh et al. 55/300
 7,785,396 B2 8/2010 Hwang et al. 95/1
 7,854,782 B2 12/2010 Oh et al. 55/429
 7,951,216 B2* 5/2011 Ha et al. 55/337
 7,958,598 B2 6/2011 Yun et al.
 2001/0025395 A1 10/2001 Matsumoto et al. 15/353
 2002/0073505 A1 6/2002 Bolden 15/340.1
 2002/0088079 A1 7/2002 Oh 15/352
 2002/0124538 A1 9/2002 Oh et al. 55/426
 2004/0211025 A1 10/2004 Jung et al. 15/353
 2004/0261216 A1 12/2004 Choi et al. 15/352
 2005/0091787 A1 5/2005 Bair et al. 15/353
 2005/0125943 A1 6/2005 Sjoberg et al.
 2005/0138763 A1 6/2005 Tanner et al. 15/353
 2005/0172584 A1 8/2005 Oh et al. 55/345
 2005/0252179 A1 11/2005 Oh et al. 55/337
 2006/0048491 A1 3/2006 Pineschi
 2006/0123750 A1 6/2006 Lee et al. 55/428
 2006/0230722 A1 10/2006 Oh et al.
 2007/0136980 A1 6/2007 Fujiwara et al. 15/339
 2007/0143953 A1 6/2007 Hwang et al. 15/353
 2007/0209149 A1 9/2007 Lee 15/352
 2007/0209339 A1 9/2007 Conrad 55/345
 2008/0023035 A1 1/2008 Ha et al. 134/18
 2008/0023036 A1 1/2008 Ha et al. 134/21
 2008/0047094 A1 2/2008 Ha et al. 15/347
 2008/0052870 A1 3/2008 Lee et al. 15/350
 2008/0172824 A1 7/2008 Yun et al. 15/352
 2008/0172993 A1 7/2008 Yun et al. 55/337
 2008/0263816 A1 10/2008 Oh et al. 15/347
 2008/0264007 A1 10/2008 Oh et al. 55/304
 2008/0264014 A1 10/2008 Oh et al. 55/423
 2008/0264015 A1 10/2008 Oh et al. 55/429
 2008/0264016 A1* 10/2008 Oh et al. 55/429
 2009/0178231 A1 7/2009 Hwang et al. 15/347
 2009/0178235 A1 7/2009 Yun et al. 15/352
 2009/0178236 A1 7/2009 Yun et al. 15/352
 2009/0229072 A1 9/2009 Hwang et al. 15/352

2009/0229073 A1 9/2009 Hwang et al. 15/352
 2009/0235956 A1 9/2009 Hwang et al. 134/21
 2009/0241286 A1 10/2009 Hwang et al. 15/347
 2009/0249578 A1 10/2009 Hwang et al. 15/352
 2009/0255083 A1 10/2009 Hwang et al. 15/347
 2009/0266382 A1 10/2009 Hwang et al. 134/21
 2009/0293221 A1 12/2009 Hwang et al. 15/347
 2009/0293223 A1 12/2009 Hwang et al. 15/352
 2009/0293224 A1 12/2009 Hyun et al. 15/353
 2009/0293915 A1 12/2009 Hwang et al. 134/21
 2010/0132319 A1* 6/2010 Ashbee et al. 55/429
 2010/0263161 A1* 10/2010 Lee et al. 15/347

FOREIGN PATENT DOCUMENTS

CN 2162679 Y 4/1994
 CN 2186039 Y 12/1994
 CN 2409894 Y 12/2000
 CN 1334061 A 2/2002
 CN 1434749 A 8/2003
 CN 1593324 A 3/2005
 CN 1695537 A 11/2005
 CN 1695538 A 11/2005
 CN 1777385 A 5/2006
 CN 1778246 A 5/2006
 DE 102 40 618 A1 9/2003
 EP 0 373 353 6/1990
 EP 0 375 327 6/1990
 EP 0 681 808 11/1995
 EP 1 136 028 B1 9/2001
 EP 1 371 318 A2 12/2003
 EP 1 671 569 6/2006
 EP 1 671 570 A1 6/2006
 EP 1 733 669 A1 12/2006
 EP 1 857 032 A2 11/2007
 FR 2 823 091 A1 10/2002
 GB 2 368 516 A 5/2002
 GB 2 377 881 A 1/2003
 GB 2 388 769 B 4/2004
 GB 2 404 887 A 2/2005
 GB 2 406 064 A 3/2005
 GB 2 416 721 A 2/2006
 GB 2466625 6/2010
 JP 1972-14759 8/1972
 JP 50-22355 3/1975
 JP 53-051663 5/1978
 JP 54-028457 3/1979
 JP 54-51259 4/1979
 JP 54-085560 A 7/1979
 JP 54-085561 A 7/1979
 JP 54-112357 8/1979
 JP 54-114366 U 8/1979
 JP 54-114367 U 8/1979
 JP 54-161751 A 12/1979
 JP 55-074553 U 5/1980
 JP 58-84066 A 5/1983
 JP 58-175532 A 10/1983
 JP 58-218934 A 12/1983
 JP 64-029246 A 1/1989
 JP 02-007927 A 1/1990
 JP 4-116933 U 10/1992
 JP 06-054778 A 3/1994
 JP 07-241265 A 9/1995
 JP 07-313412 12/1995
 JP 08-000514 A 1/1996
 JP 08-112223 A 5/1996
 JP 08-140907 A 6/1996
 JP 10-243900 A 9/1998
 JP 11-004789 A 1/1999
 JP 2000-262449 A 9/2000
 JP 2002-143060 A 5/2002
 JP 2002-187336 A 7/2002
 JP 2002-360474 A 12/2002
 JP 2003-019097 A 1/2003
 JP 2003-119575 A 4/2003
 JP 2003-125995 A 5/2003
 JP 2003-190056 A 7/2003
 JP 2003-199695 A 7/2003
 JP 2003-524522 A 8/2003

(56)

References Cited

FOREIGN PATENT DOCUMENTS

JP	2003-310502	A	11/2003
JP	2003-310506	A	11/2003
JP	2004-065357	A	3/2004
JP	2004-528087	A	9/2004
JP	2004-528876		9/2004
JP	2005-034213	A	2/2005
JP	2005-324002		11/2005
JP	2006-3119575	U	2/2006
JP	2006-061439	A	3/2006
JP	2006-068500	A	3/2006
JP	2006-340972		12/2006
JP	2007-007381	A	1/2007
JP	2008-073066	A	4/2008
KR	10-1993-0008369	B1	8/1993
KR	10-1995-0016643		7/1995
KR	10-1999-0050243		7/1999
KR	10-1999-0055544		7/1999
KR	20-2000-0011635		7/2000
KR	10-2001-0081856		8/2001
KR	10-2001-0087691		9/2001
KR	10-2002-0012383		2/2002
KR	10-2002-0091510	A	12/2002
KR	10-2003-0094869		12/2003
KR	10-0437369		6/2004
KR	10-2005-0005611	A	1/2005
KR	10-2005-0013694	A	2/2005
KR	10-2005-0025711		3/2005
KR	10-2005-0040122		5/2005
KR	10-2005-0108623		11/2005
KR	10-2005-0109145		11/2005
KR	10-0546629	B1	1/2006
KR	10-0553042	B1	2/2006
KR	10-2006-0031442	A	4/2006
KR	10-2006-0116992	A	11/2006
KR	10-0730956	B1	6/2007
KR	10-2007-084834	A	8/2007
KR	10-2007-0088022	A	8/2007
KR	10-2007-0088023		8/2007
KR	10-2007-0112324		11/2007
KR	10-2007-0113353		11/2007
KR	10-0800188	B1	1/2008
KR	10-0800189	B1	1/2008
KR	10-0838886	B1	6/2008
KR	10-0838887	B1	6/2008
RU	2 172 132	C1	8/2001
RU	2 243 714	C1	1/2005
RU	2 269 919	C2	9/2005
WO	WO 00/74548	A1	12/2000
WO	WO 01/35809	A1	5/2001
WO	WO 01/60524	A1	8/2001
WO	WO 0174493		10/2001
WO	WO 2004/064591	A2	8/2004
WO	WO 2005/099545	A1	10/2005

OTHER PUBLICATIONS

U.S. Office Action issued in U.S. Appl. No. 12/407,983 dated Jun. 21, 2011.

U.S. Notice of Allowance issued in U.S. Appl. No. 12/407,293 dated Jun. 29, 2011.

U.S. Office Action issued in U.S. Appl. No. 12/407,243 dated Jul. 18, 2011.

U.S. Office Action issued in U.S. Appl. No. 12/404,692 dated Jul. 20, 2011.

U.S. Office Action issued in U.S. Appl. No. 12/404,715 dated Jul. 22, 2011.

U.S. Office Action issued in U.S. Appl. No. 12/407,975 dated Jul. 28, 2011.

U.S. Office Action issued in U.S. Appl. No. 12/407,243 dated Sep. 19, 2012.

U.S. Office Action issued in U.S. Appl. No. 12/720,160 dated Dec. 4, 2012.

U.S. Office Action issued in U.S. Appl. No. 12/704,915 dated Dec. 10, 2012.

U.S. Office Action dated Nov. 3, 2010 issued in U.S. Appl. No. 12/710,585.

U.S. Final Office Action dated Nov. 8, 2010 issued in U.S. Appl. No. 12/406,803.

U.S. Office Action dated Nov. 12, 2010 issued in U.S. Appl. No. 12/704,933.

Russian Office Action dated Oct. 19, 2010 issued in Application No. 2009143355 (with English translation).

Chinese Office Action dated Oct. 27, 2010 issued in Application No. 200610168848.0 (with English translation).

Chinese Office Action dated Nov. 9, 2010 issued in Application No. 200610169333.2 (with English translation).

U.S. Notice of Allowance dated Jan. 12, 2011 issued in U.S. Appl. No. 11/965,133.

U.S. Office Action issued in U.S. Appl. No. 12/407,243 dated Nov. 16, 2011.

U.S. Office Action issued in U.S. Appl. No. 12/404,692 dated Dec. 7, 2011.

U.S. Office Action issued in U.S. Appl. No. 12/404,715 dated Dec. 8, 2011.

U.S. Notice of Allowance issued in U.S. Appl. No. 12/710,585 dated Dec. 30, 2011.

U.S. Office Action issued in U.S. Appl. No. 12/407,975 dated Jan. 30, 2012.

Russian Office Action dated Sep. 28, 2007 issued in Application No. 2007103559 (translation only).

Russian Office Action dated Oct. 1, 2007 issued in Application No. 2007103555 (translation).

U.S. Office Action dated Feb. 11, 2008 issued in U.S. Appl. No. 11/831,473.

U.S. Office Action dated Feb. 11, 2008 issued in U.S. Appl. No. 11/831,564.

Australian Office Action dated Apr. 15, 2008 issued in Application No. 2007200407.

Australian Office Action dated Apr. 17, 2008 issued in Application No. 2007200408.

Russian Office Action dated Apr. 21, 2008 issued in Application No. 2007103560 (with translation).

Australian Office Action dated Apr. 24, 2008 issued in Application No. 2007200409.

European Office Action dated May 8, 2008 issued in Application No. 07 101 388.2-2316.

Australian Office Action dated Jun. 3, 2008 issued in Application No. 2006249267.

U.S. Final Office Action dated Jul. 24, 2008 issued in U.S. Appl. No. 11/831,473.

U.S. Office Action dated Jul. 28, 2008 issued in U.S. Appl. No. 11/712,958.

U.S. Office Action dated Aug. 28, 2008 issued in U.S. Appl. No. 11/713,022.

U.S. Office Action dated Sep. 19, 2008 issued in U.S. Appl. No. 11/831,564.

U.S. Office Action dated Oct. 20, 2008 issued in U.S. Appl. No. 11/831,473.

International Search Report and Written Opinion dated Dec. 10, 2008 issued in Application No. PCT/KR2008/004849.

Chinese Office Action dated Dec. 12, 2008 issued in Application No. 200710002992.1 (translation).

U.S. Final Office Action dated Mar. 9, 2009 issued in U.S. Appl. No. 11/713,022.

Russian Office Action dated Mar. 25, 2009 issued in Application No. 2008102660 (with translation).

Chinese Office Action dated Apr. 3, 2009 issued in Application No. 200710002990.2 (with translation).

Australian Office Action dated Apr. 16, 2009 issued in Application No. 2008200340.

Chinese Office Action dated May 8, 2009 issued in Application No. 200610153199.7 (translation).

U.S. Office Action dated May 13, 2009 issued in U.S. Appl. No. 11/965,133.

Chinese Office Action dated May 22, 2009 issued in Application No. 200710002292.1 (translation).

(56)

References Cited

OTHER PUBLICATIONS

U.S. Final Office Action dated May 28, 2009 issued in U.S. Appl. No. 11/831,473.
 Chinese Office Action dated Jun. 5, 2009 issued in Application No. 200610169333.2 (translation).
 European Search Report dated Jun. 16, 2009 issued in Application No. 06 12 5823 (in English).
 Chinese Office Action dated Jul. 3, 2009 issued in Application No. 200610168848.0 (with translation).
 Chinese Office Action dated Aug. 21, 2009 issued in Application No. 200710002991.7 (with translation).
 Chinese Office Action dated Aug. 21, 2009 issued in Application No. 200810008716.0 (with translation).
 U.S. Office Action dated Sep. 3, 2009 issued in U.S. Appl. No. 11/831,564.
 U.S. Office Action dated Sep. 10, 2009 issued in U.S. Appl. No. 11/565,241.
 U.S. Office Action dated Oct. 6, 2009 issued in U.S. Appl. No. 12/406,803.
 European Search Report dated Oct. 15, 2009 issued in Application No. 06 12 5560.0-2316.
 Japanese Office Action dated Nov. 4, 2009 issued in Application No. 2007-019770 (with translation).
 Chinese Office Action dated Nov. 13, 2009 issued in Application No. 200710085701.X (with translation).
 Canadian Office Action dated Nov. 18, 2009 issued in Application No. 2,598,113.
 Canadian Office Action dated Nov. 18, 2009 issued in Application No. 2,598,117.
 Chinese Office Action dated Dec. 11, 2009 issued in Application No. 200710002992.1 (with translation).
 U.S. Notice of Allowance dated Jan. 13, 2010 issued in U.S. Appl. No. 11/565,133.
 European Search Report dated Jan. 20, 2010 issued in Application No. 06 12 5560.
 Chinese Office Action dated Feb. 5, 2010 issued in Application No. 200710002991.7 (with translation).
 U.S. Notice of Allowance dated Feb. 19, 2010 issued in U.S. Appl. No. 11/565,241.
 U.S. Notice of Allowance dated Feb. 24, 2010 issued in U.S. Appl. No. 11/831,564.
 U.S. Office Action dated Apr. 19, 2010 issued in U.S. Appl. No. 11/565,206.
 U.S. Notice of Allowance dated Apr. 21, 2010 issued in U.S. Appl. No. 11/831,519.
 U.S. Office Action dated May 14, 2010 issued in U.S. Appl. No. 11/831,473.

U.S. Office Action dated May 26, 2010 issued in U.S. Appl. No. 12/406,803.
 Canadian Office Action dated Jun. 30, 2010 issued in Application No. 2,598,113.
 U.S. Office Action dated Jul. 9, 2010 issued in U.S. Appl. No. 11/965,133.
 U.S. Office Action dated Jul. 23, 2010 issued in U.S. Appl. No. 12/408,066.
 U.S. Office Action dated Aug. 18, 2010 issued in U.S. Appl. No. 12/406,779.
 U.S. Office Action dated Sep. 1, 2010 issued in U.S. Appl. No. 11/831,473.
 U.S. Notice of Allowance dated Oct. 1, 2010 issued in U.S. Appl. No. 11/565,206.
 European Search Report dated Mar. 19, 2012.
 U.S. Office Action issued in U.S. Appl. No. 12/407,243 dated Apr. 6, 2012.
 U.S. Notice of Allowance issued in U.S. Appl. No. 12/404,715 dated Apr. 26, 2012.
 U.S. Office Action issued in U.S. Appl. No. 12/406,779 dated Feb. 3, 2011.
 U.S. Office Action issued in U.S. Appl. No. 11/831,473 dated Feb. 4, 2011.
 U.S. Office Action issued in U.S. Appl. No. 12/408,066 dated Feb. 10, 2011.
 U.S. Office Action issued in U.S. Appl. No. 12/710,585 dated Feb. 10, 2011.
 U.S. Office Action issued in U.S. Appl. No. 12/404,739 dated Feb. 18, 2011.
 U.S. Office Action issued in U.S. Appl. No. 12/404,692 dated Mar. 9, 2011.
 U.S. Office Action issued in U.S. Appl. No. 12/404,715 dated Mar. 9, 2011.
 U.S. Notice of Allowance issued in U.S. Appl. No. 12/408,066 dated Mar. 21, 2011.
 U.S. Notice of Allowance issued in U.S. Appl. No. 12/407,224 dated Mar. 28, 2011.
 European Search Report dated Jan. 27, 2011. (Application No. 06125798.6-2316/1852048).
 Russian Office Action dated Feb. 2, 2011 (Application No. 2009143355) (with translation).
 U.S. Office Action issued in U.S. Appl. No. 12/720,160 dated Jun. 24, 2013.
 U.S. Office Action issued in U.S. Appl. No. 12/406,803 dated Aug. 21, 2013.
 U.S. Notice of Allowance issued in U.S. Appl. No. 12/407,243 dated Jun. 6, 2013.
 U.S. Office Action issued in U.S. Appl. No. 12/720,115 dated May 23, 2014.

* cited by examiner

FIG. 1

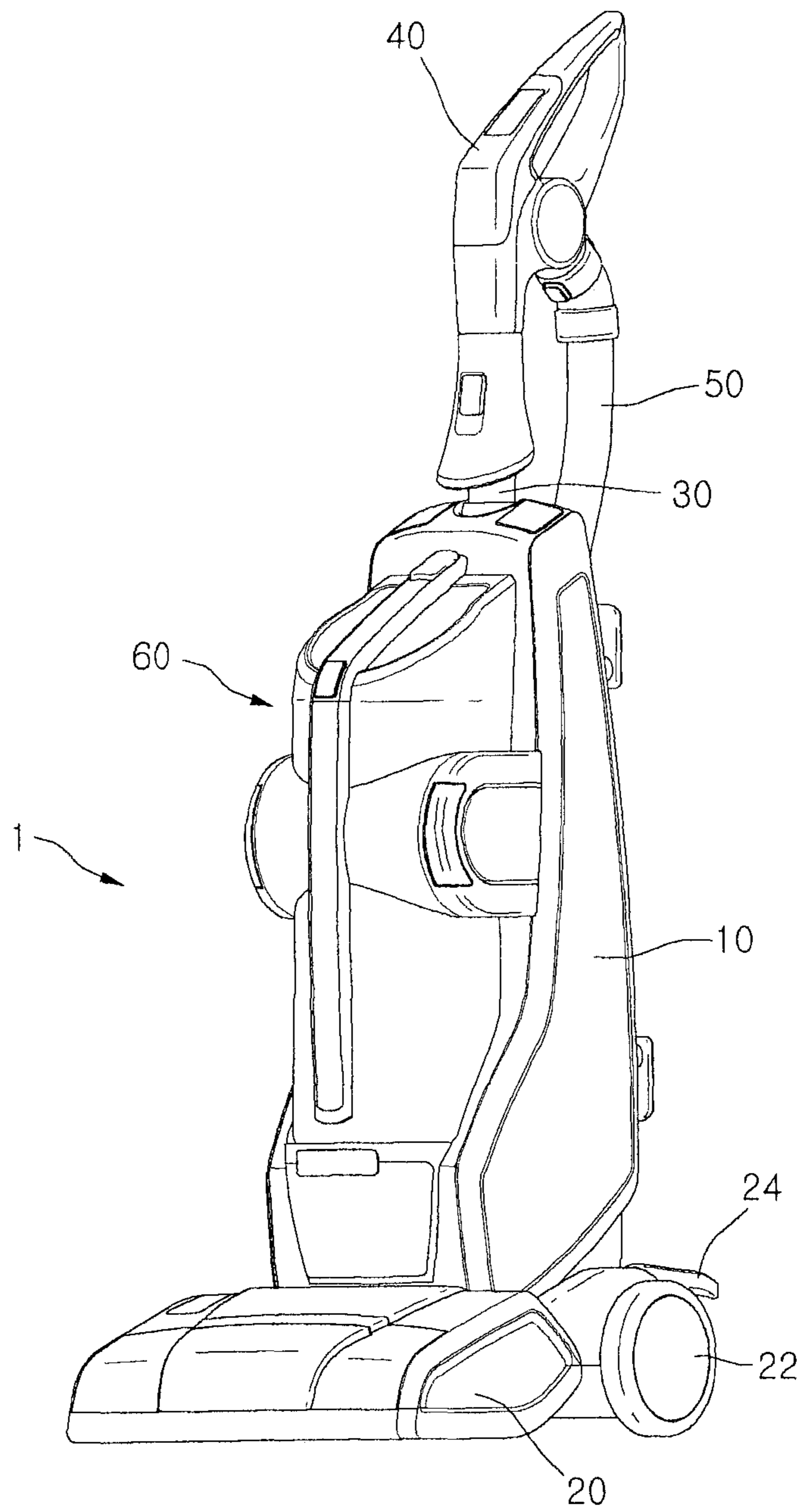


FIG. 2

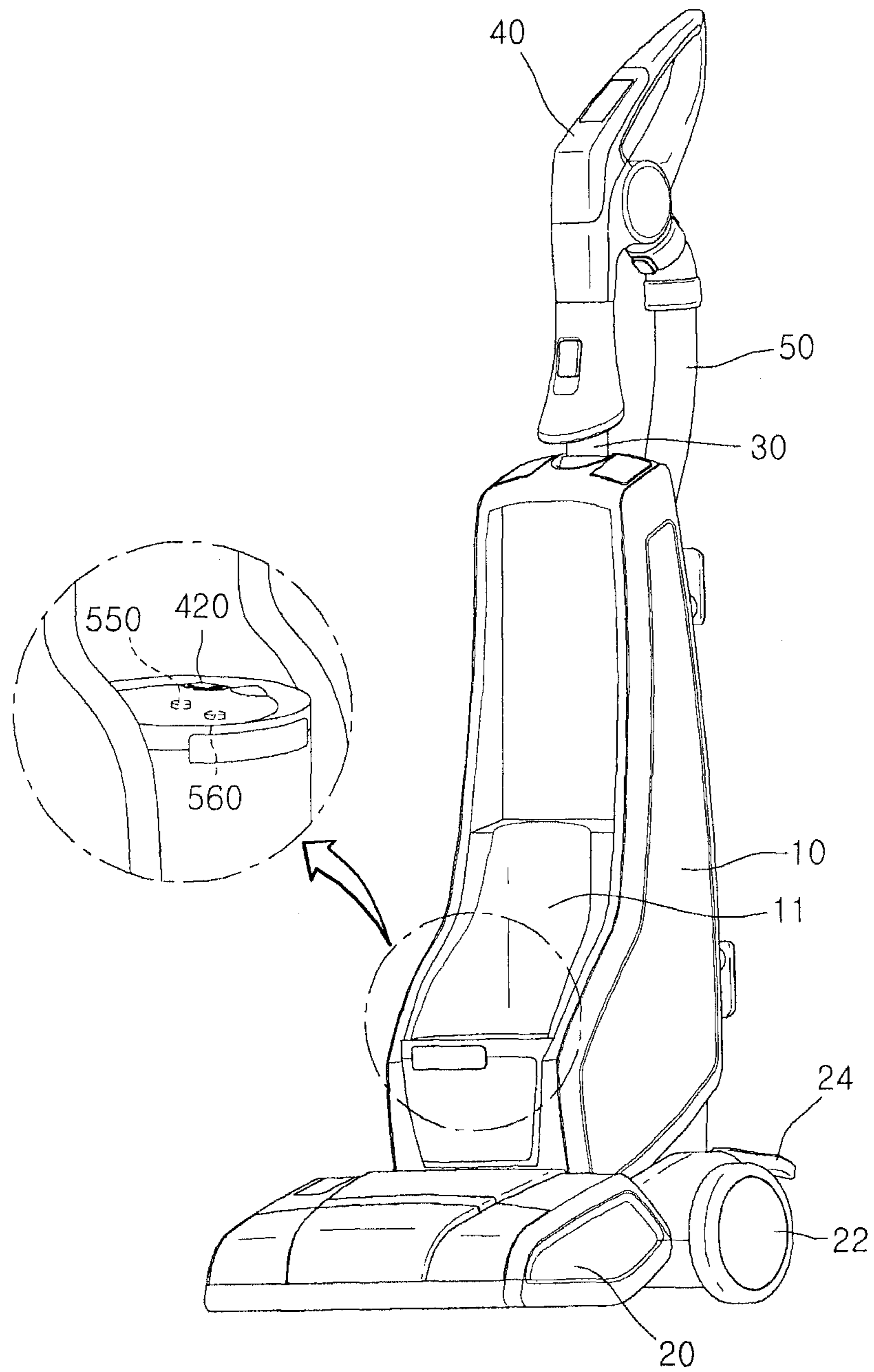


FIG. 3

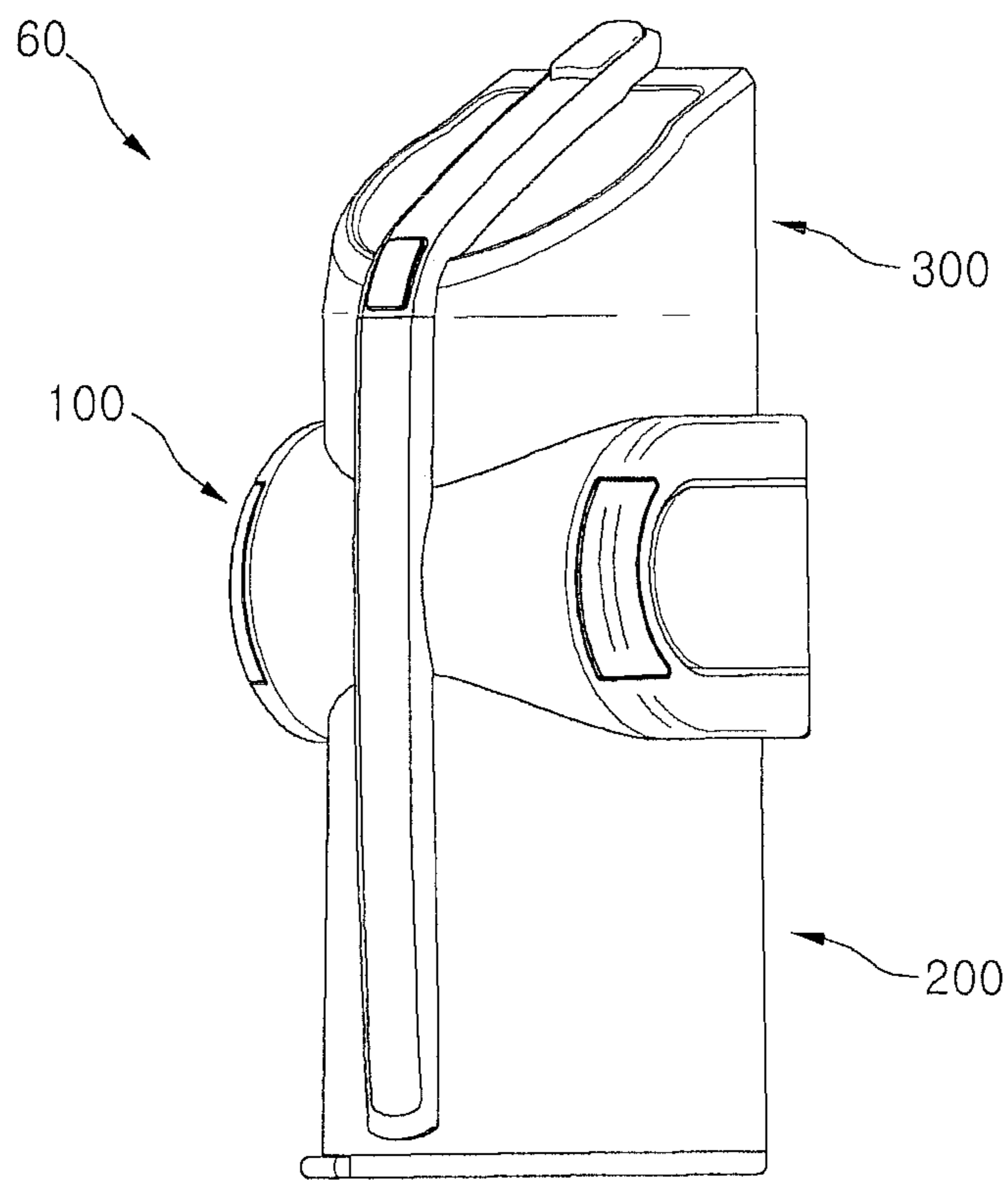


FIG. 4

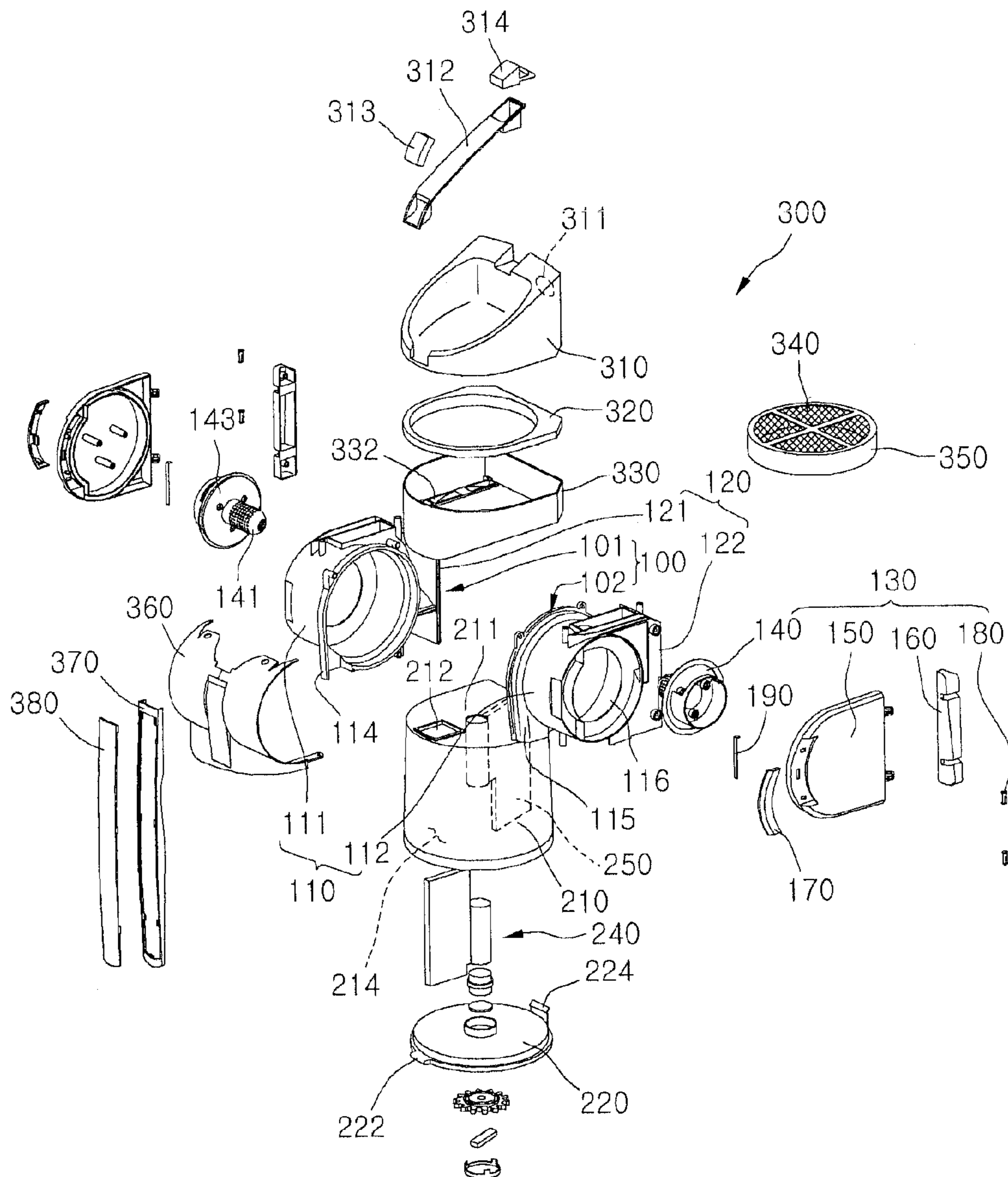


FIG. 5

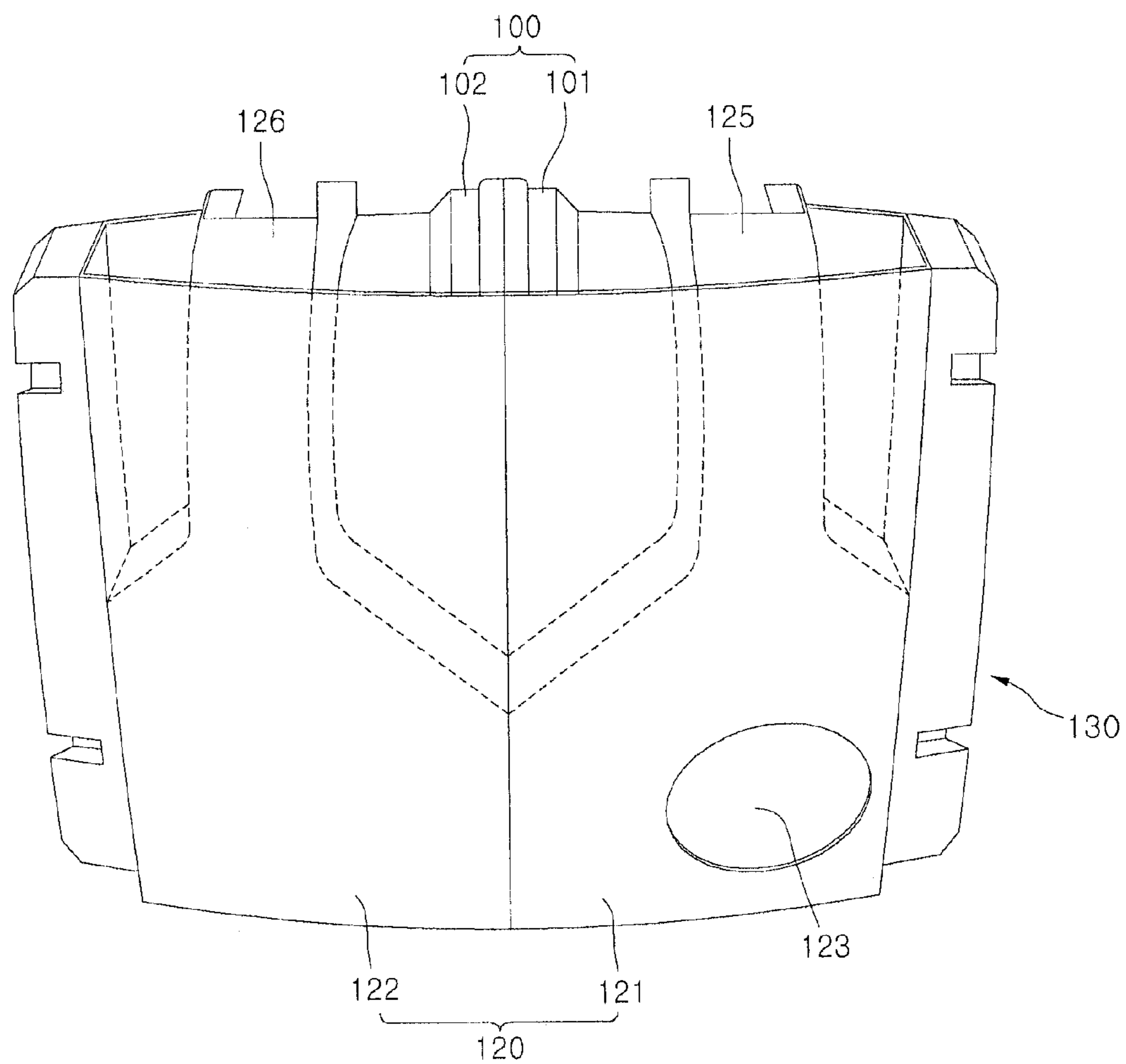


FIG. 6

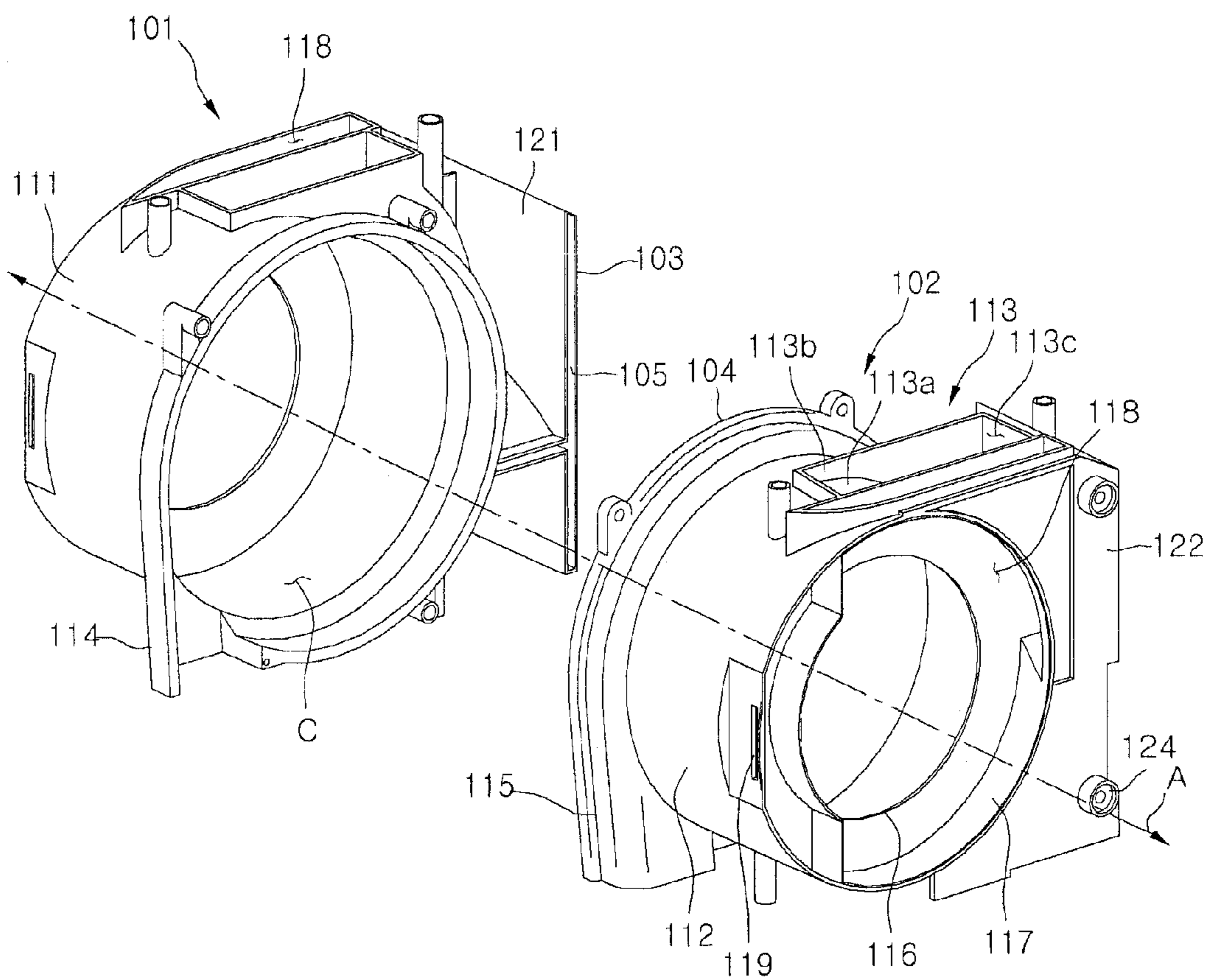


FIG. 7

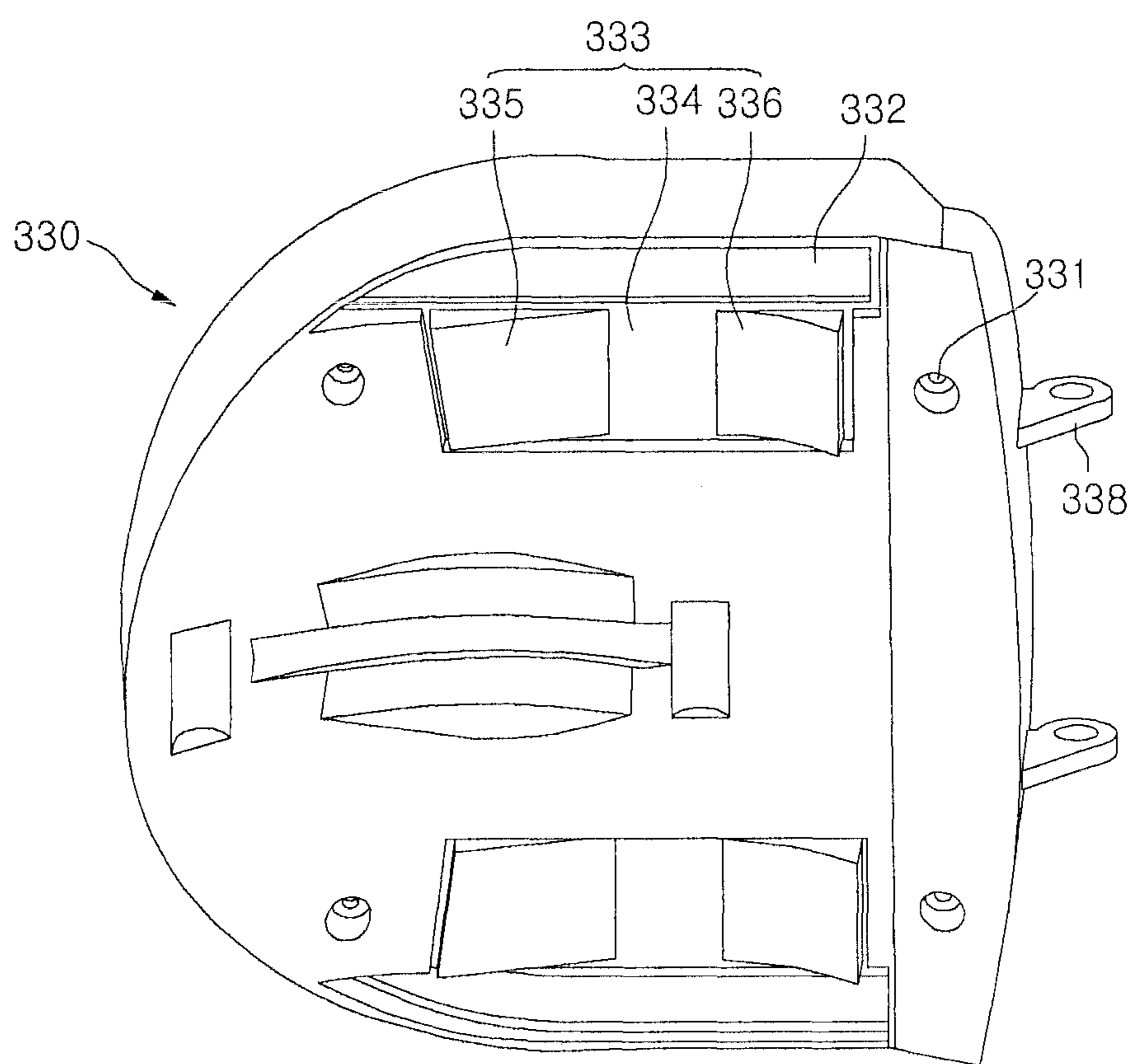


FIG. 8

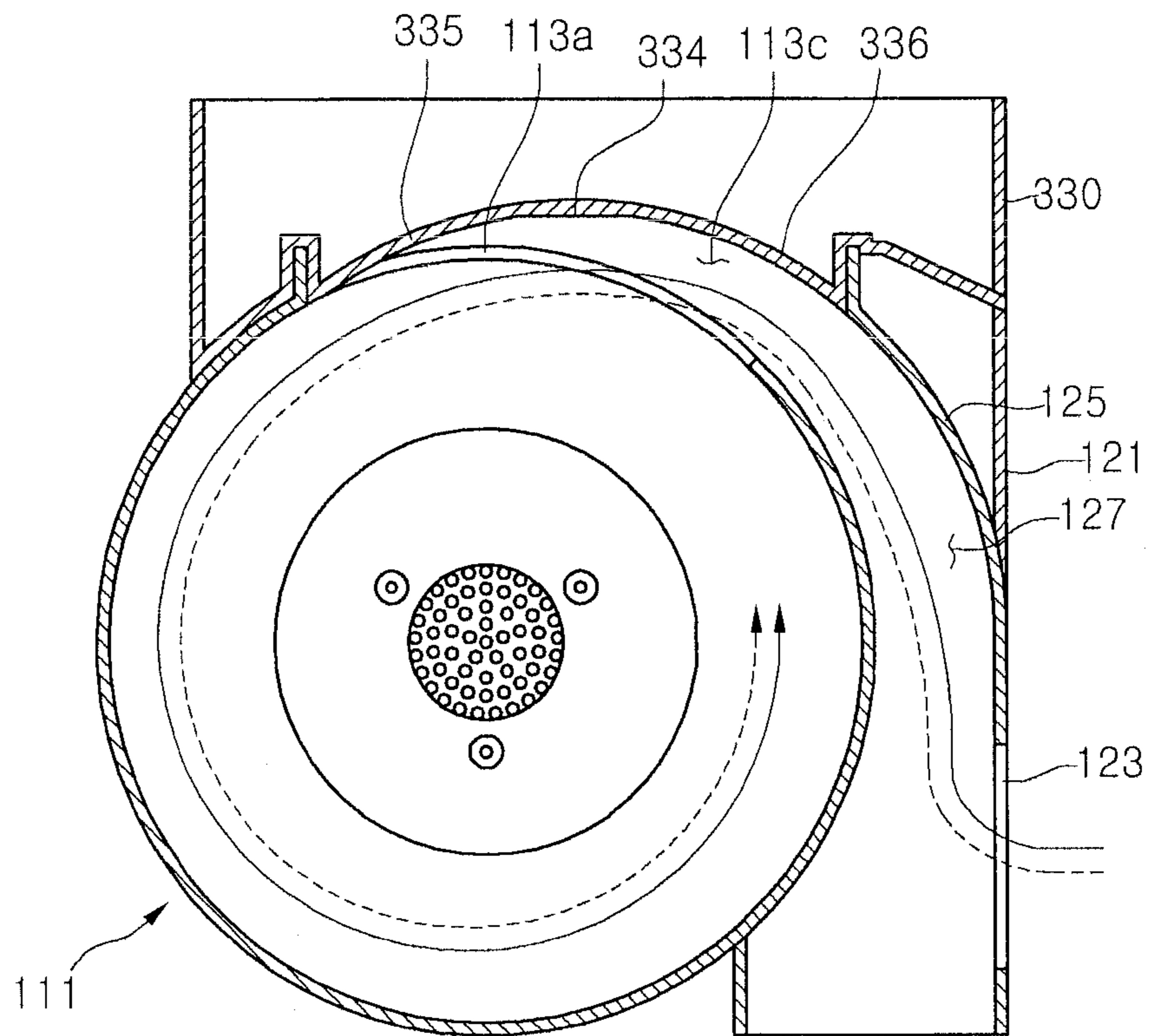


FIG. 9

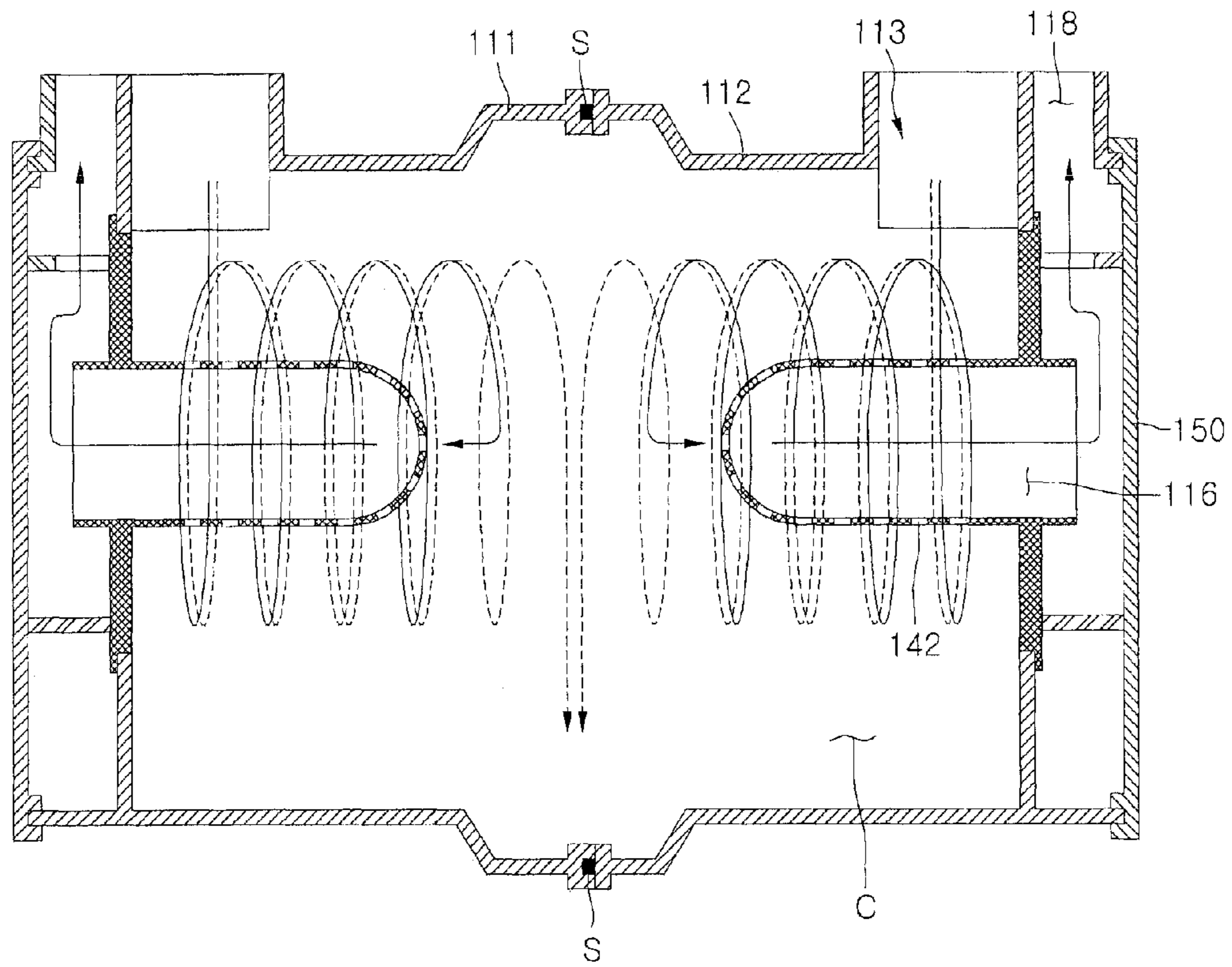


FIG. 10

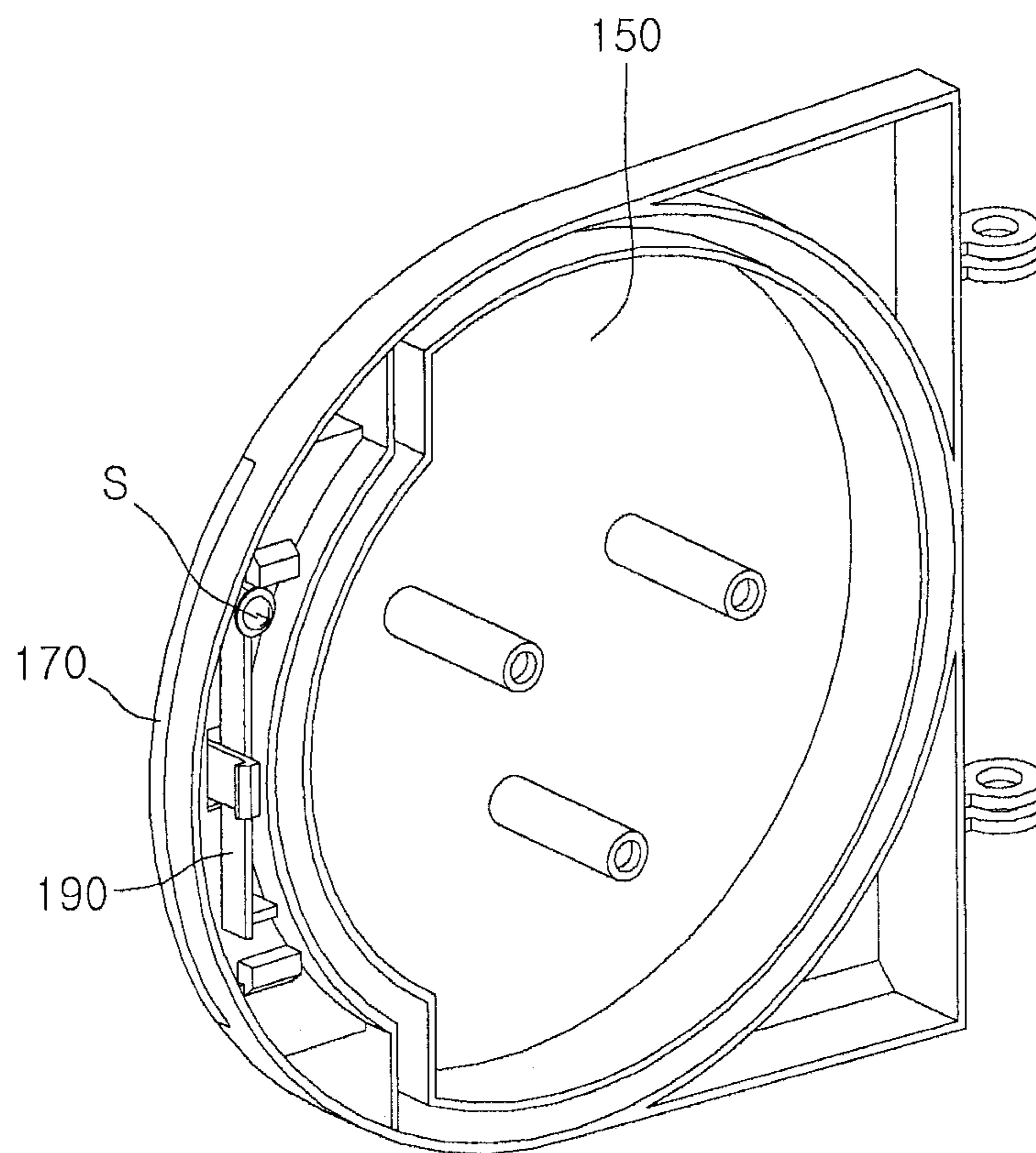


FIG. 11

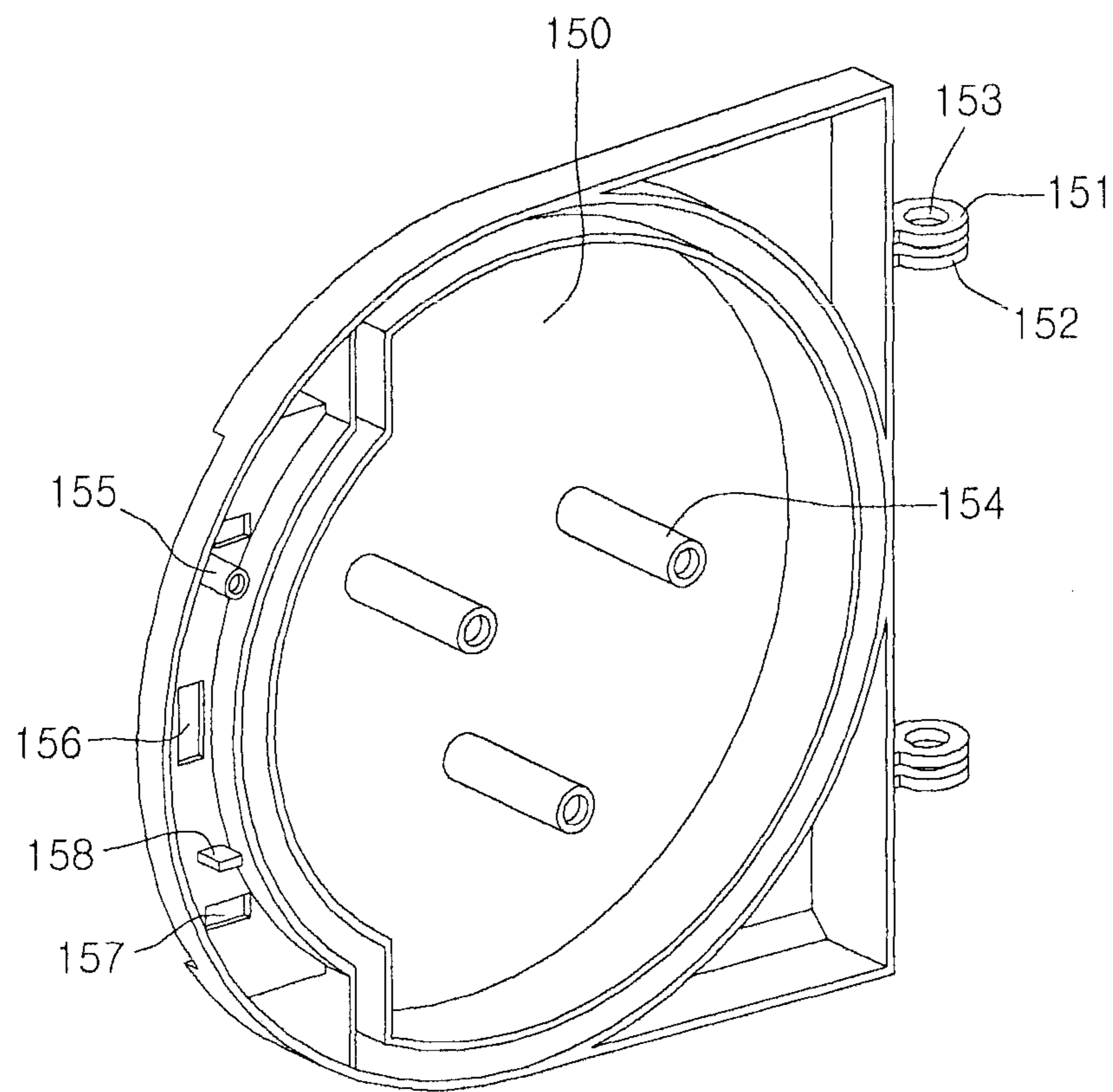


FIG. 12

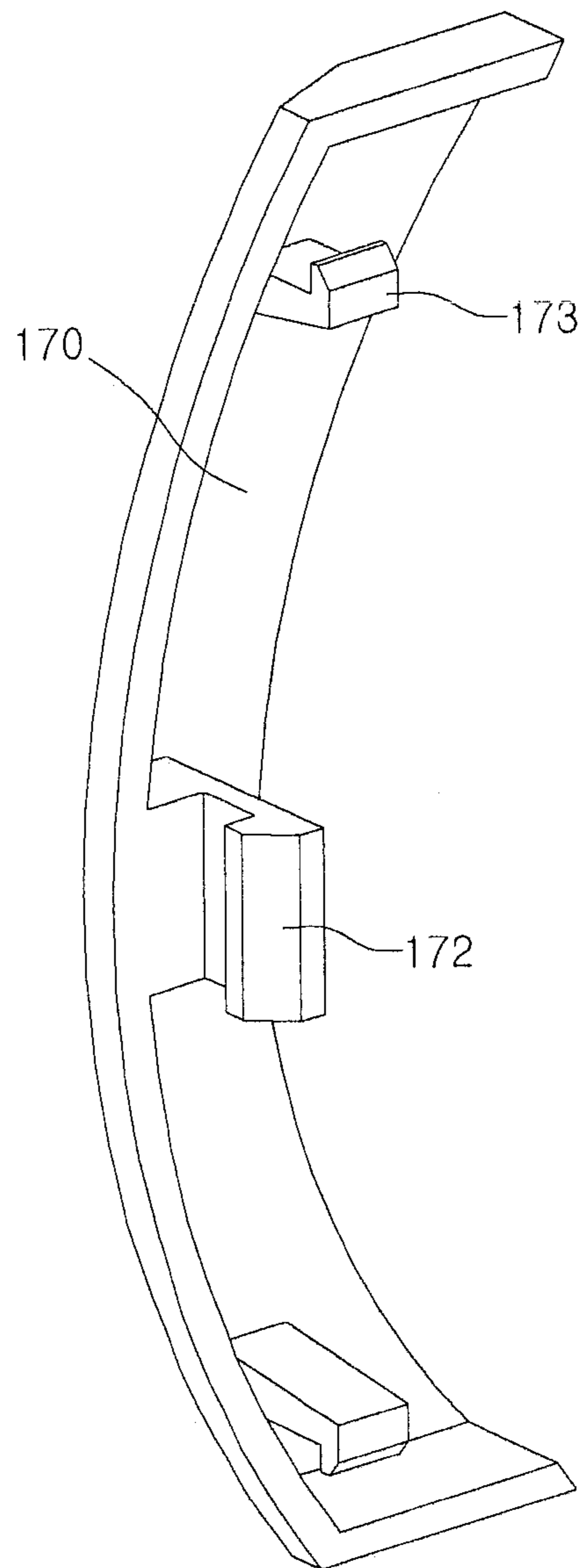


FIG. 13

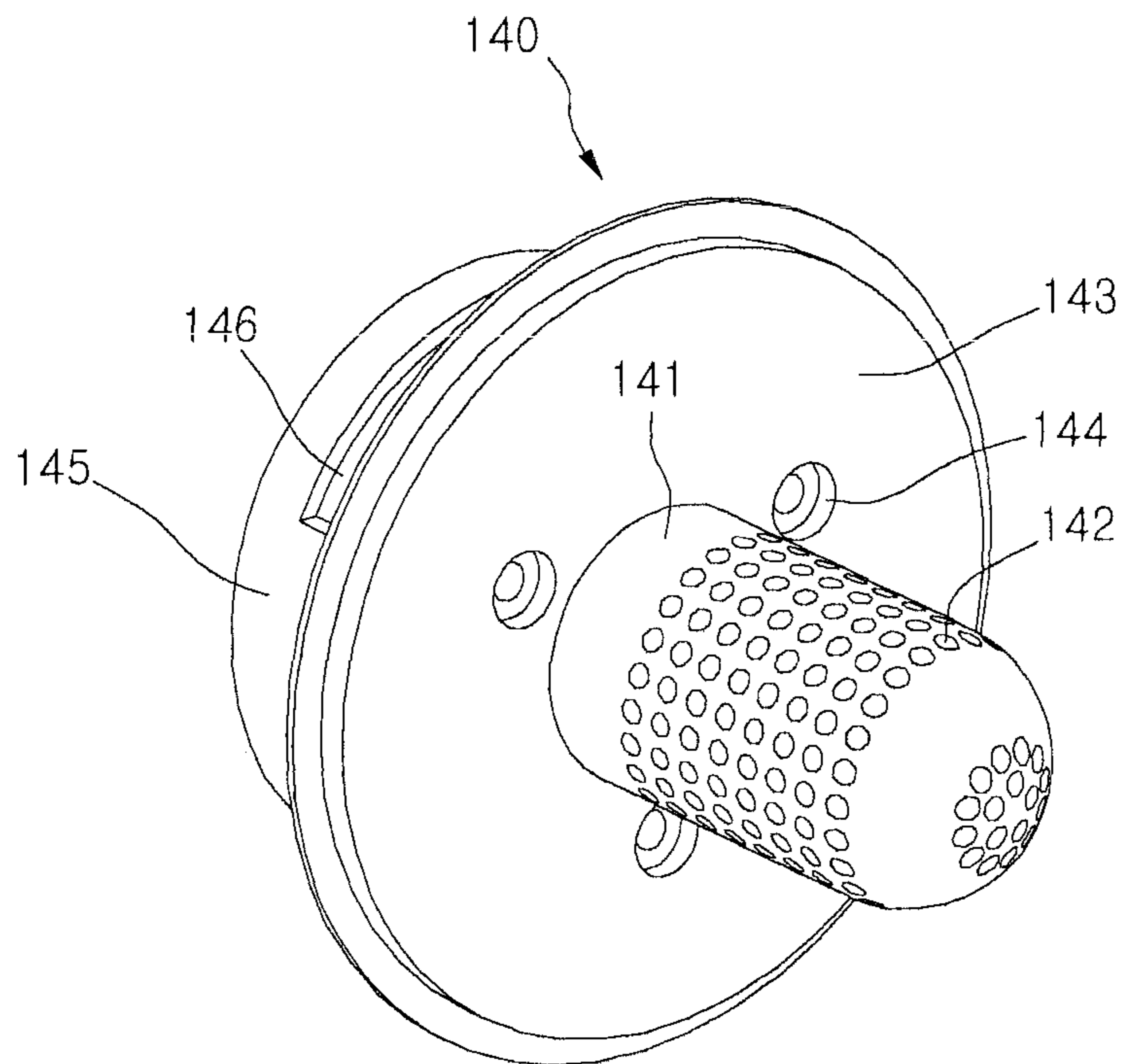


FIG. 14

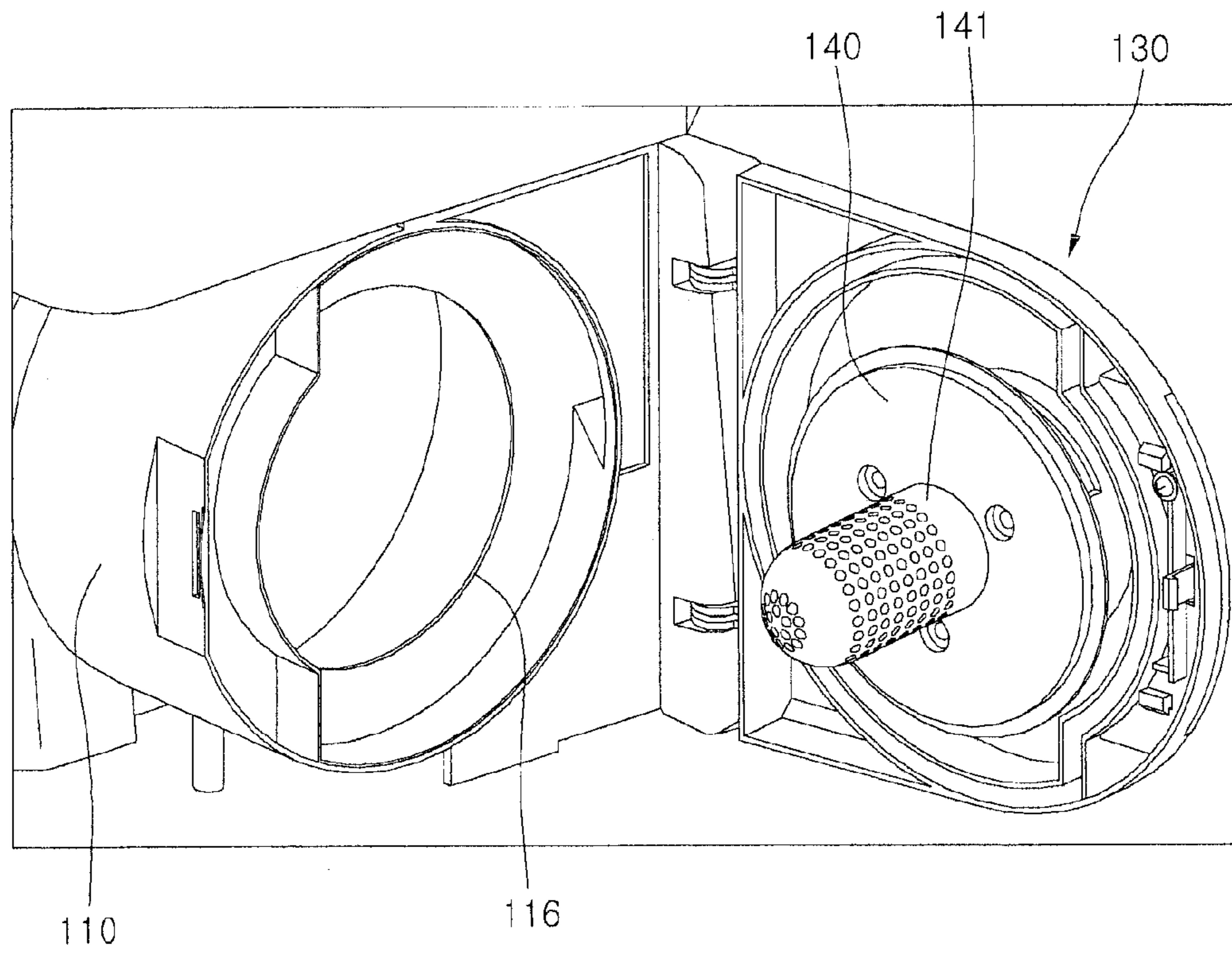


FIG. 15

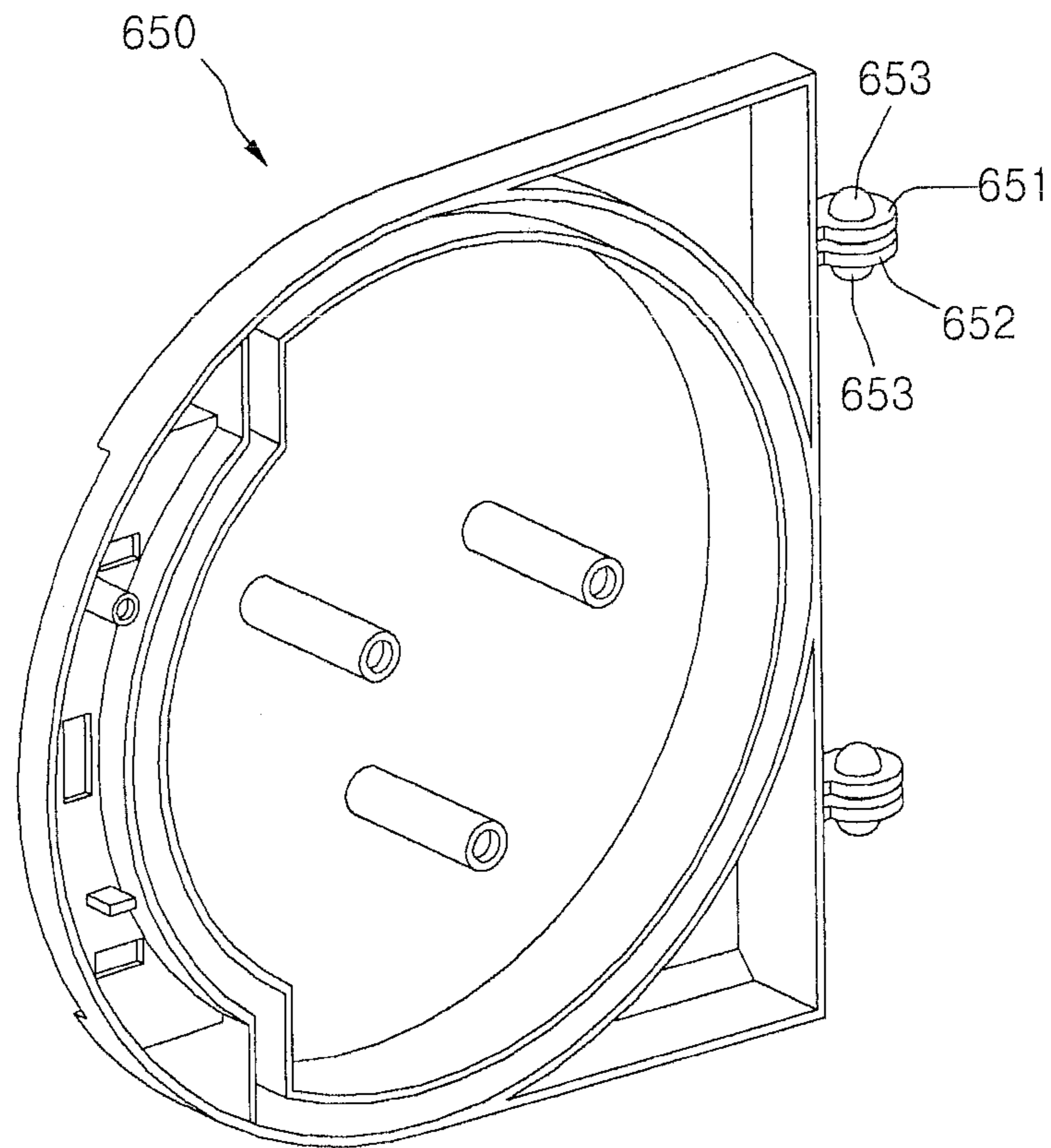


Fig. 16

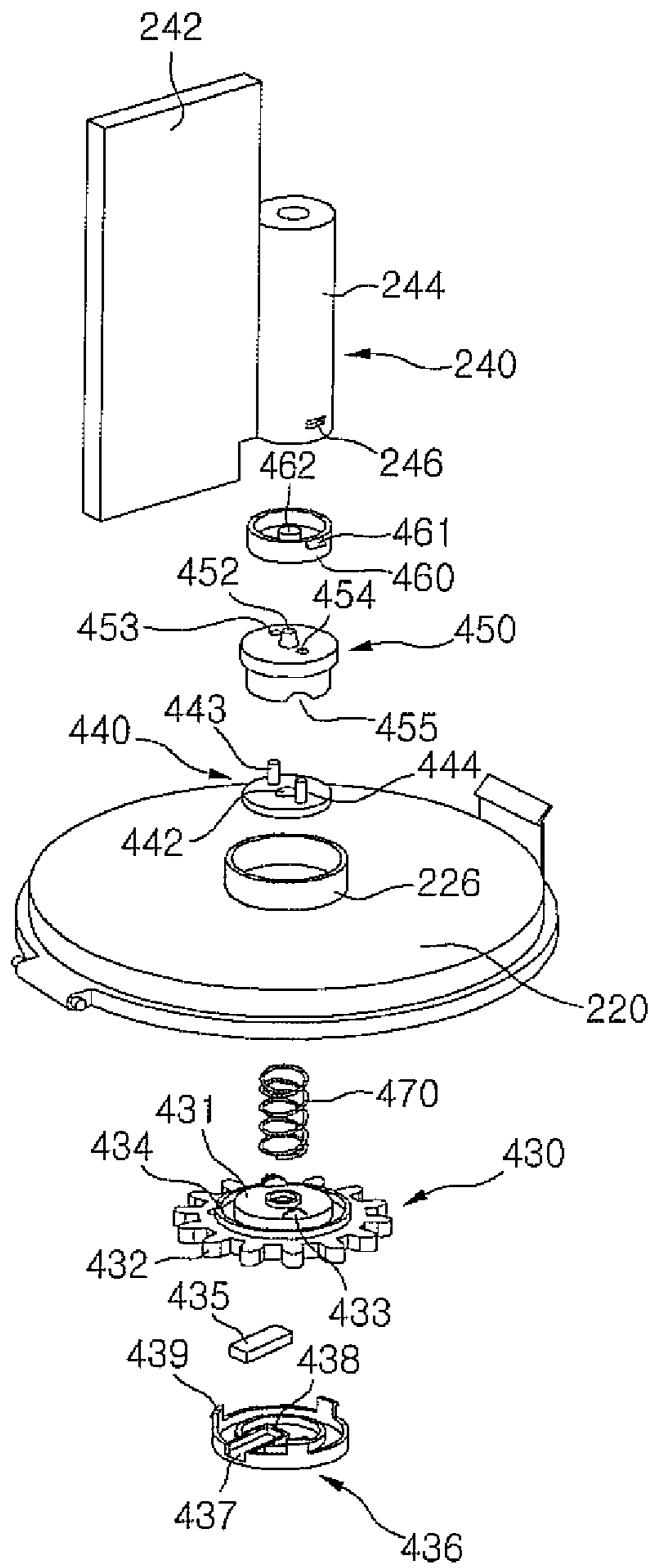


Fig. 17

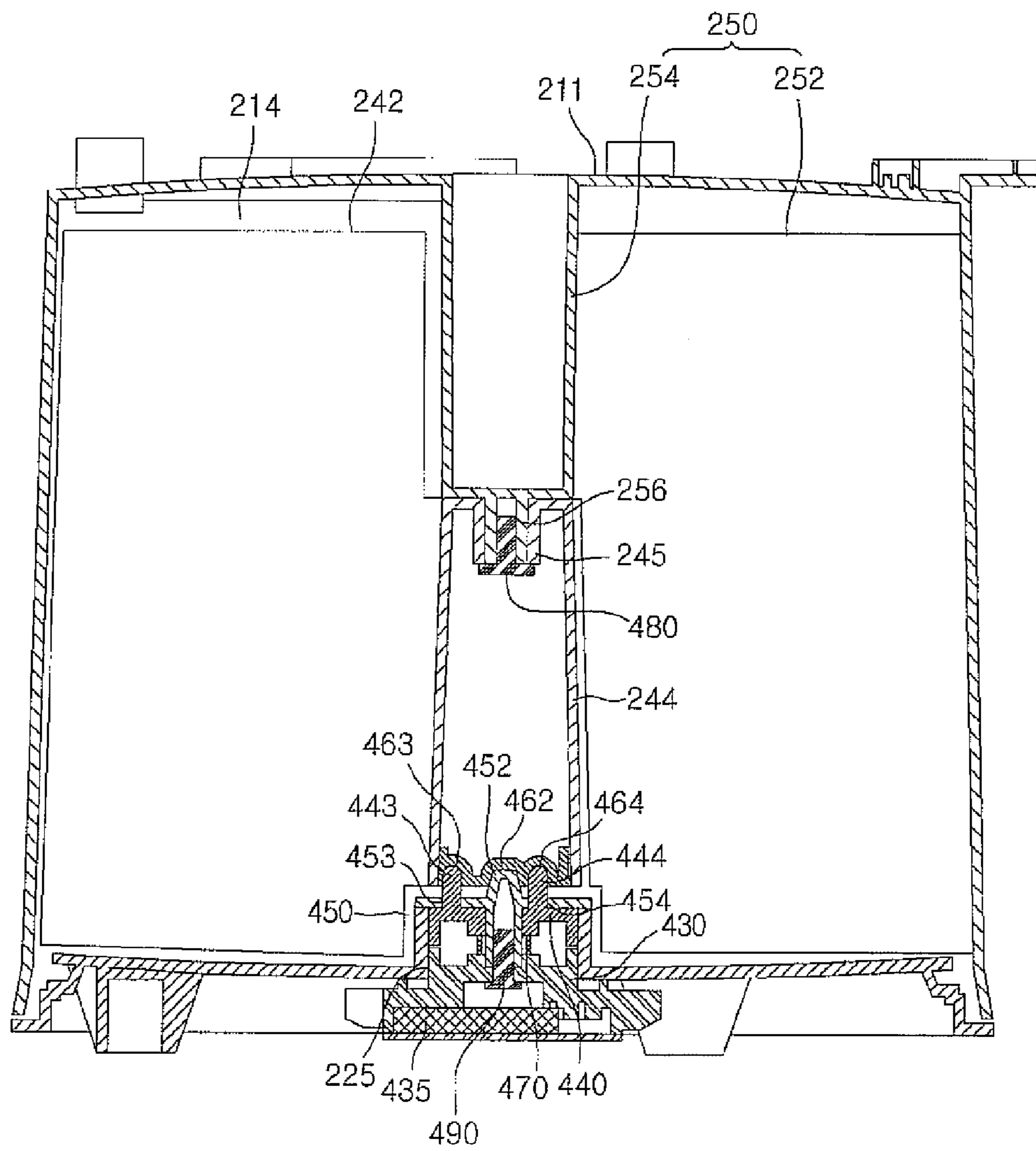


Fig. 18

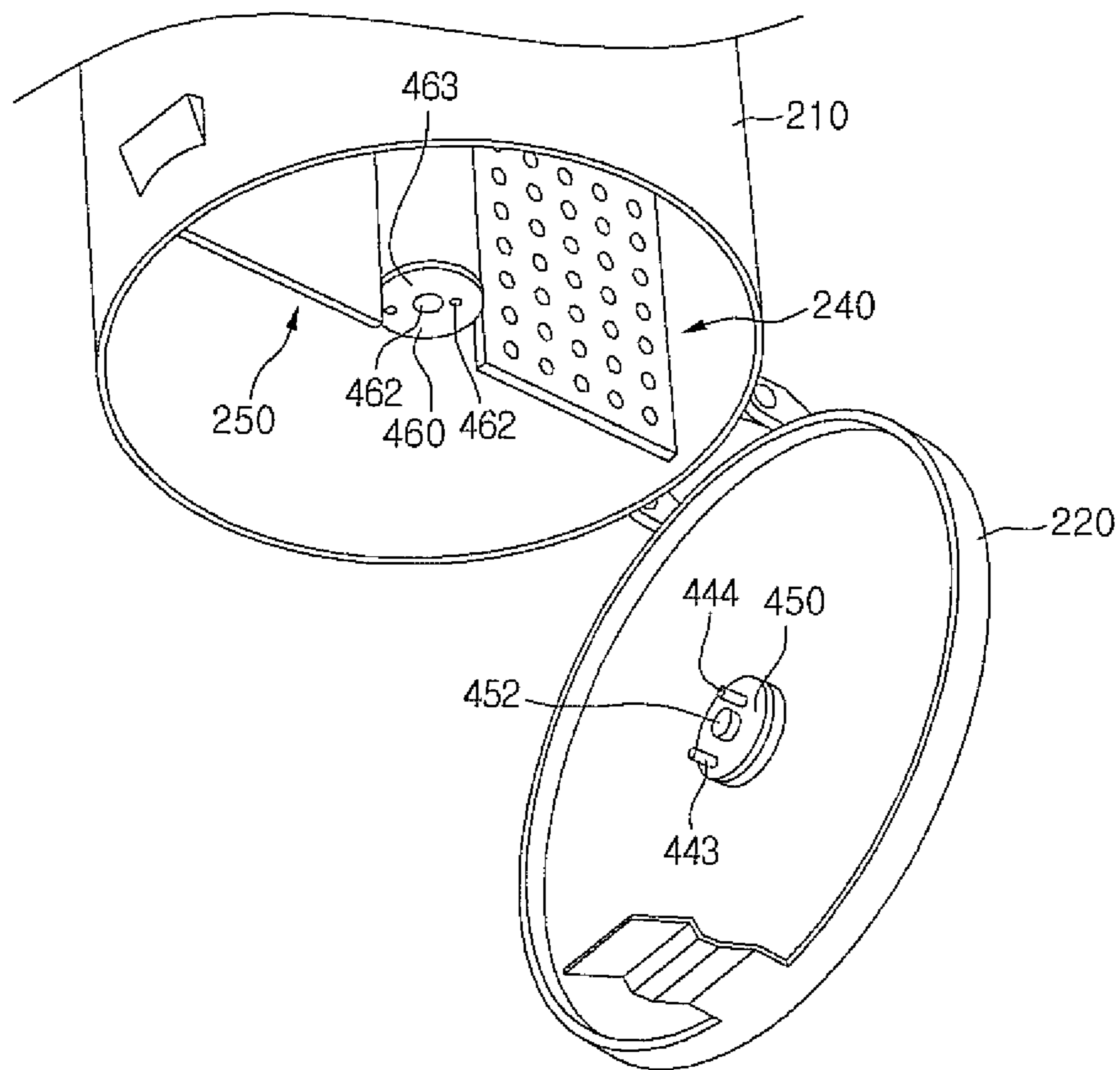


Fig. 19

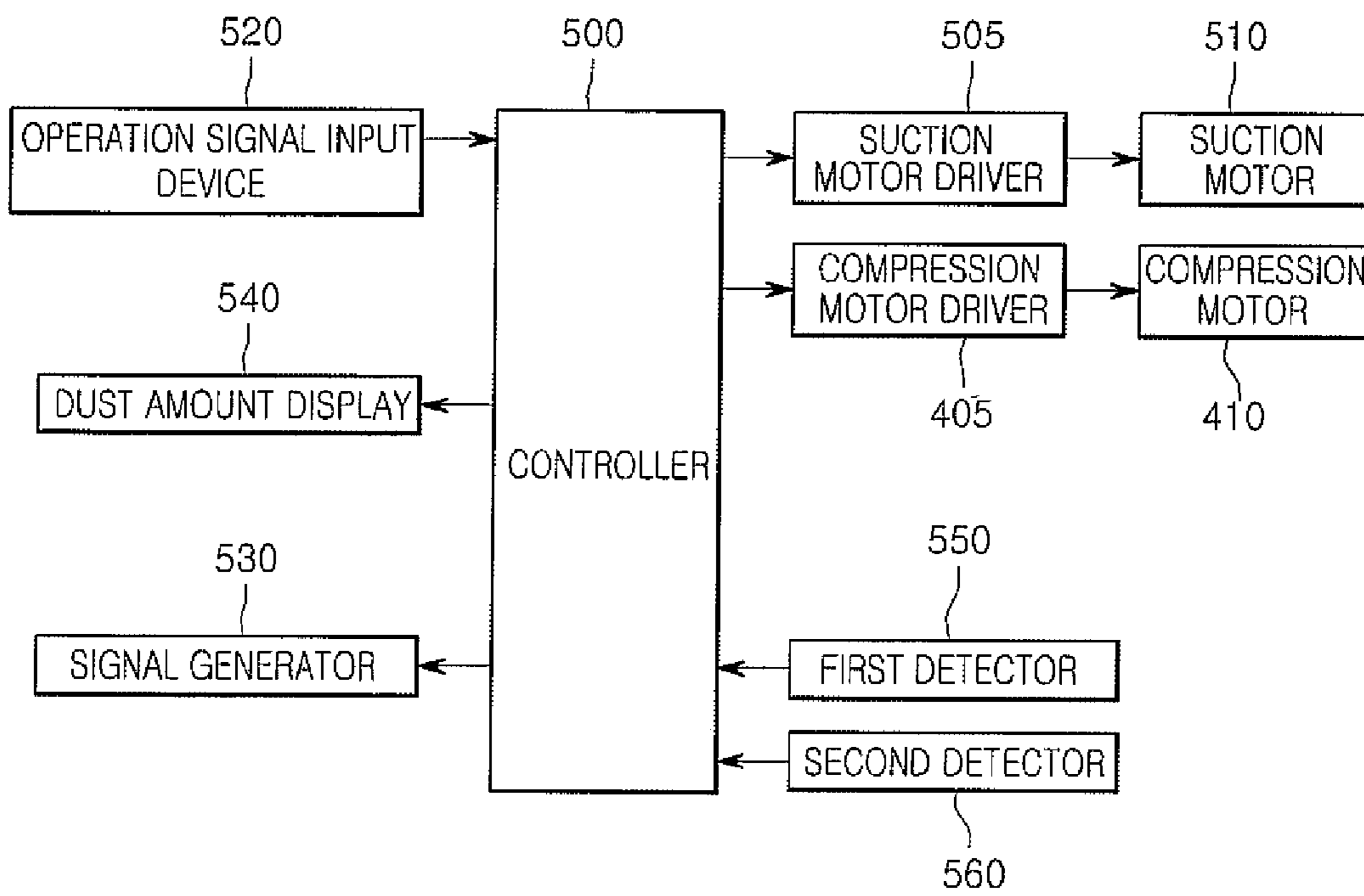


FIG. 20

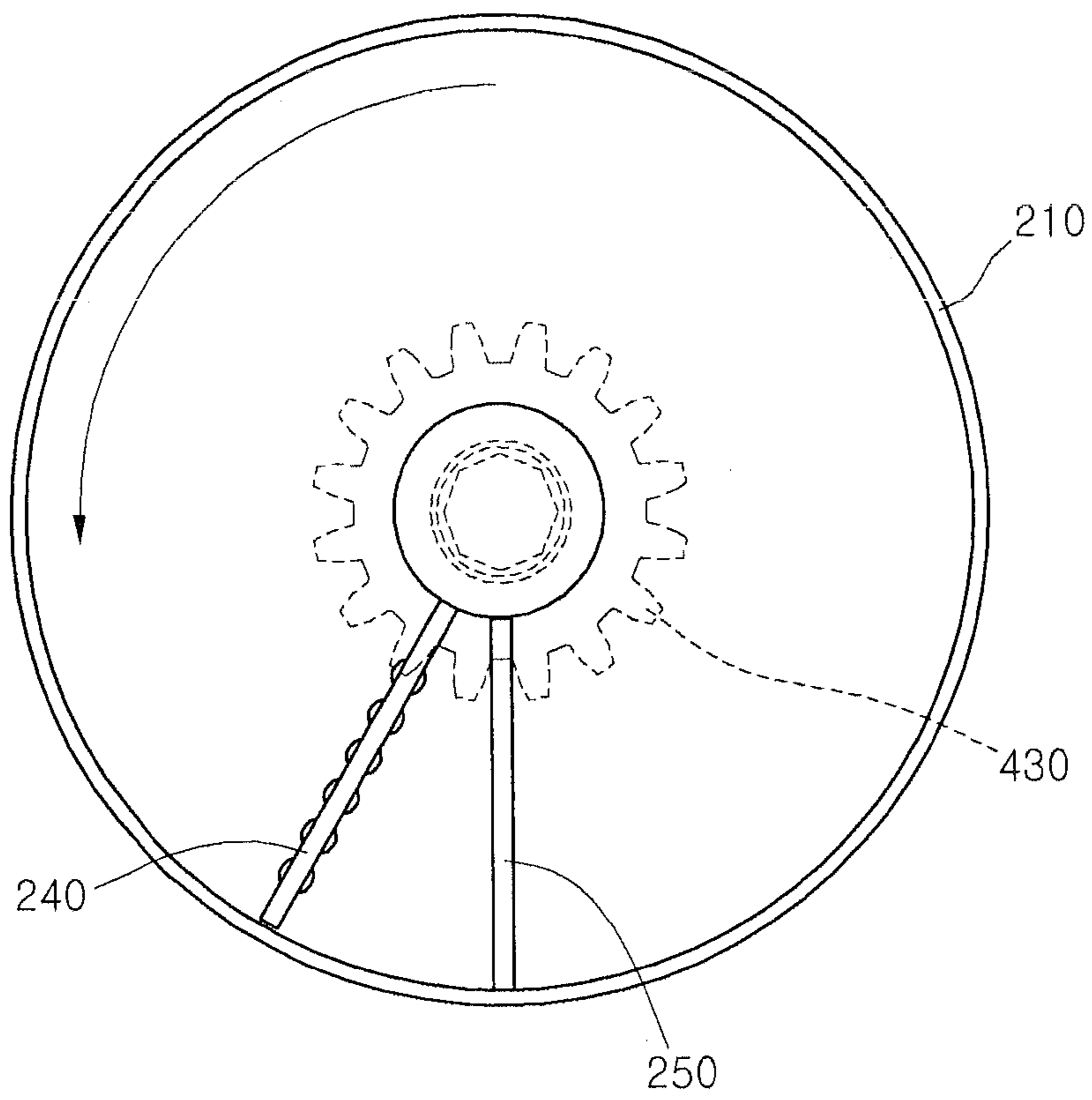


FIG. 21

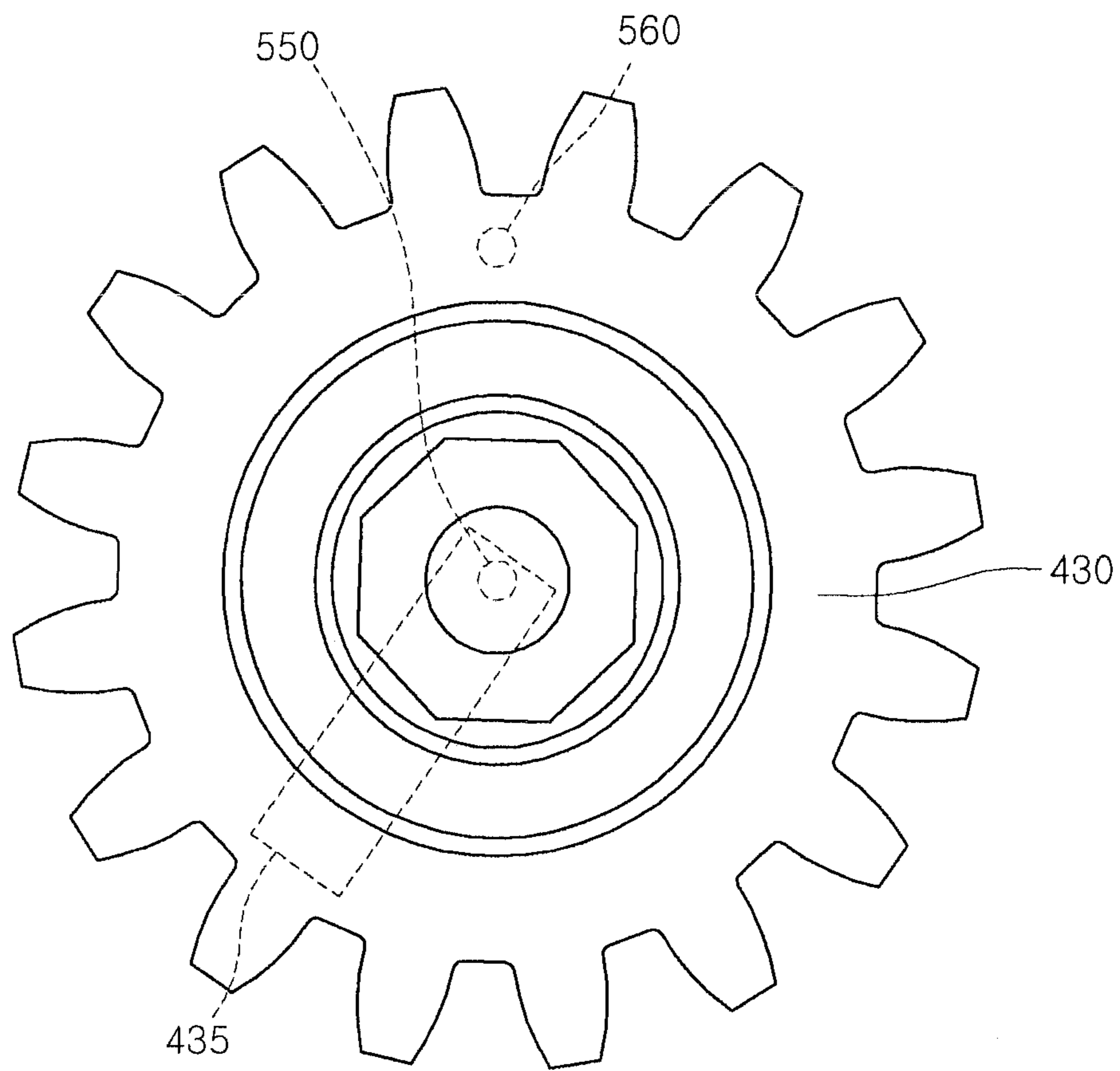


FIG. 22

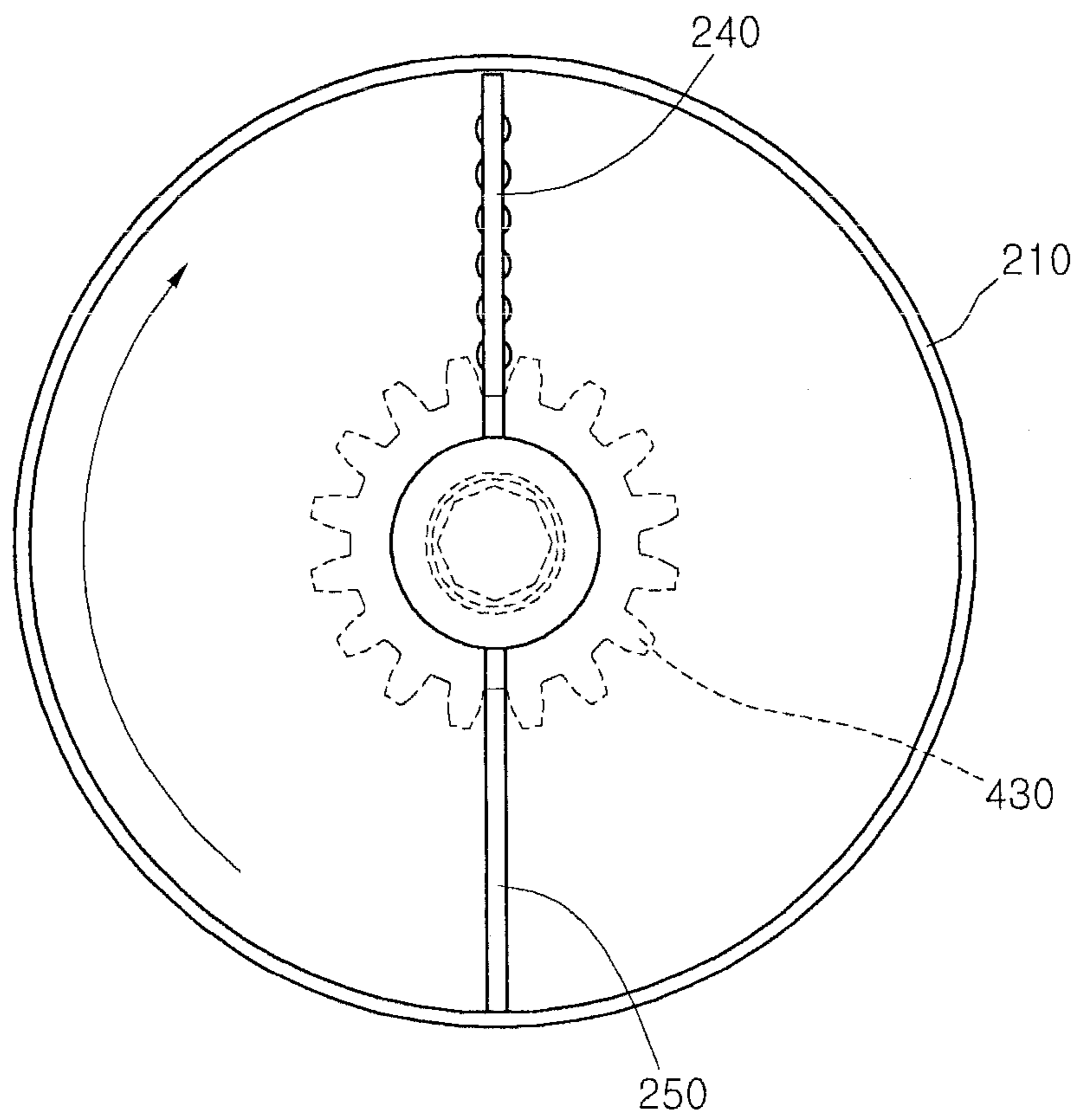


FIG. 23

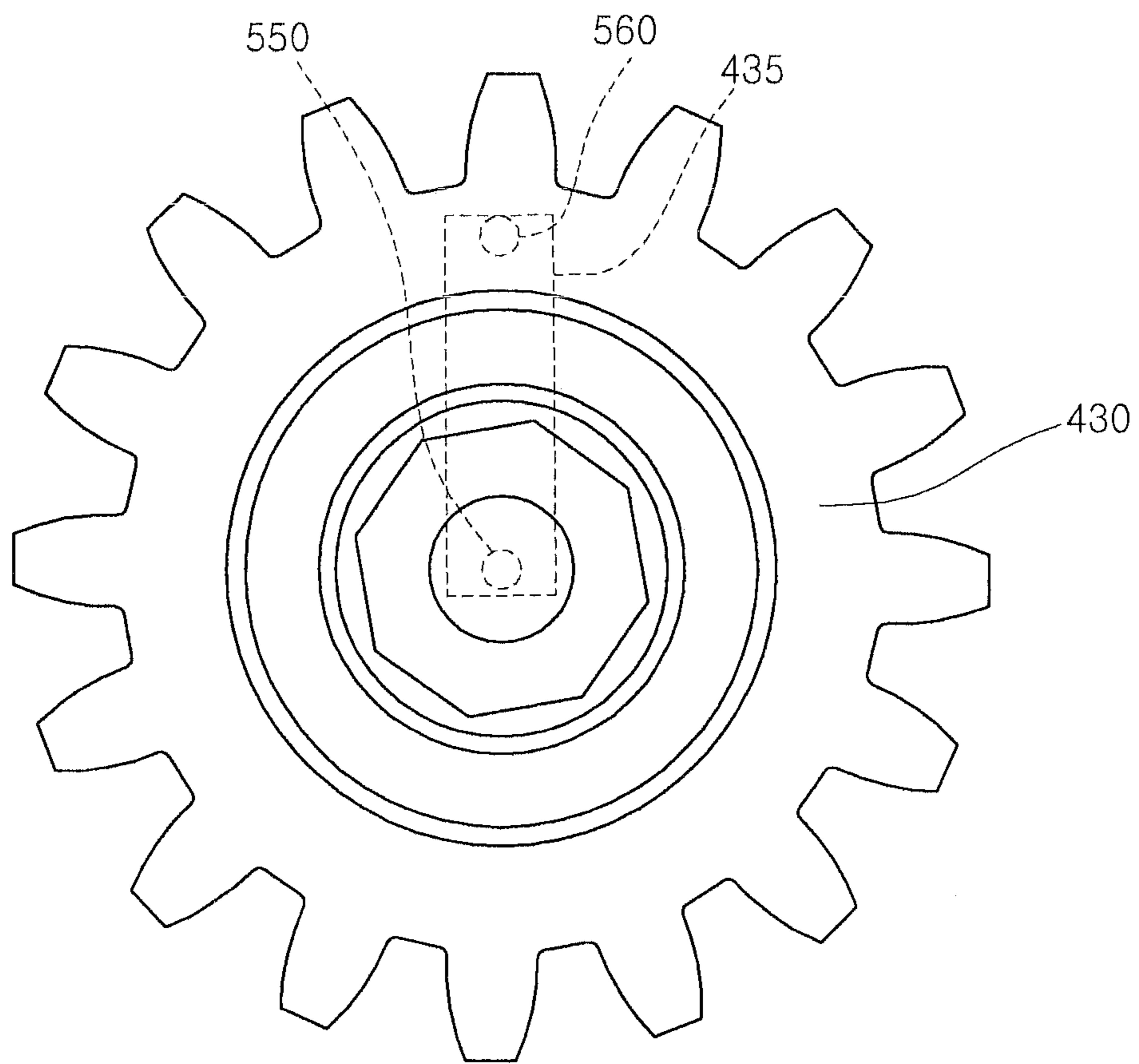


FIG. 24

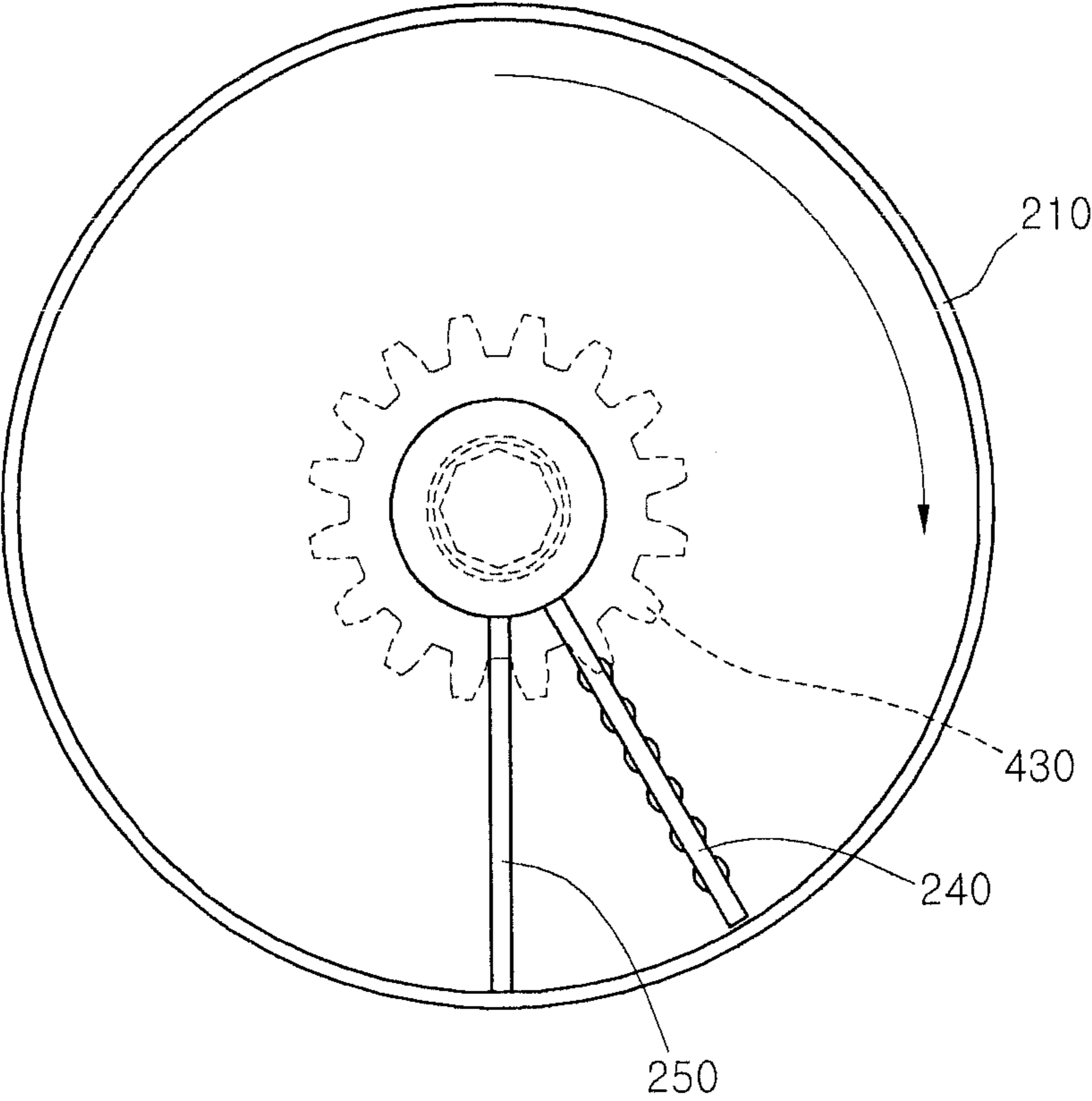


FIG. 25

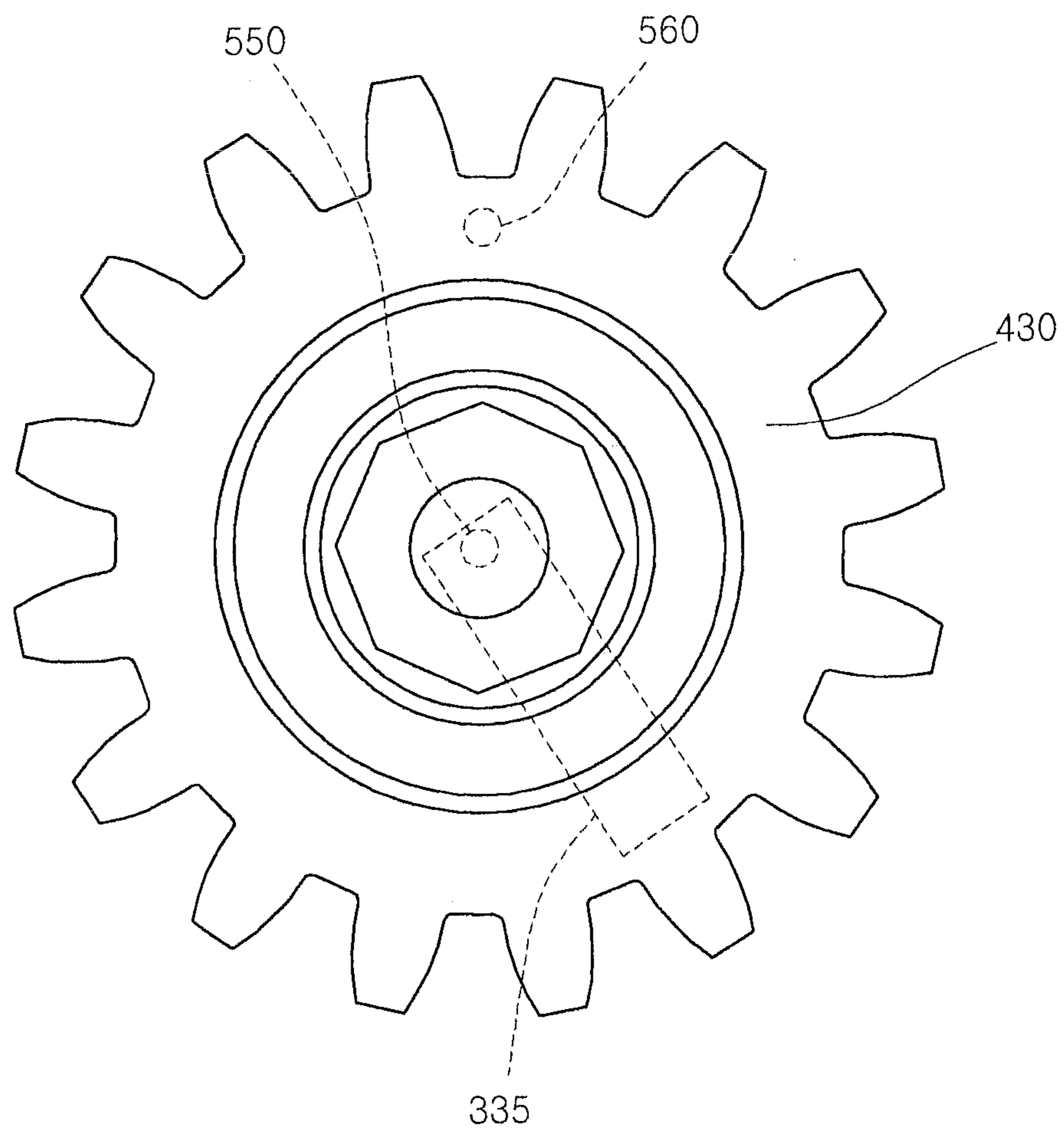


FIG. 26

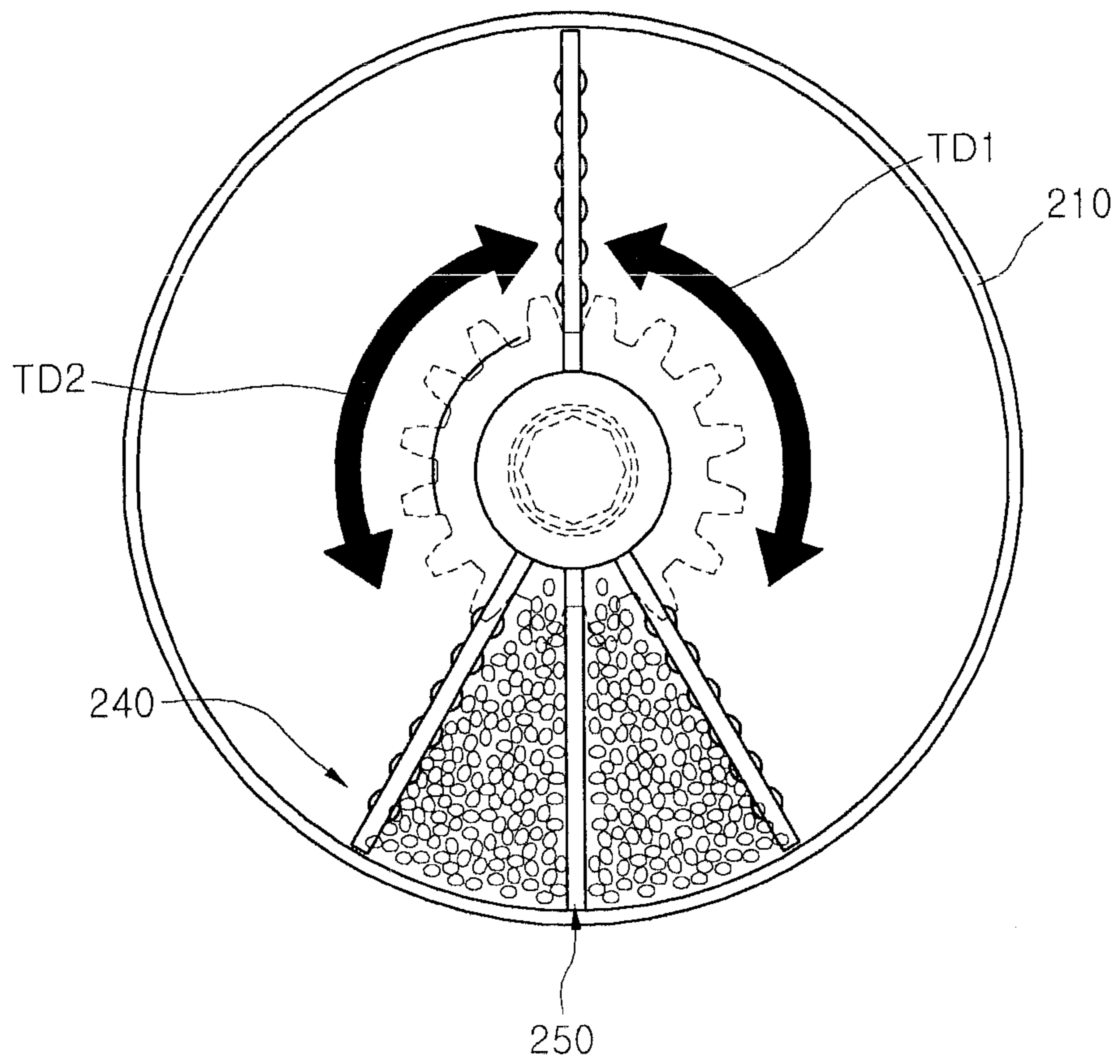


FIG. 27

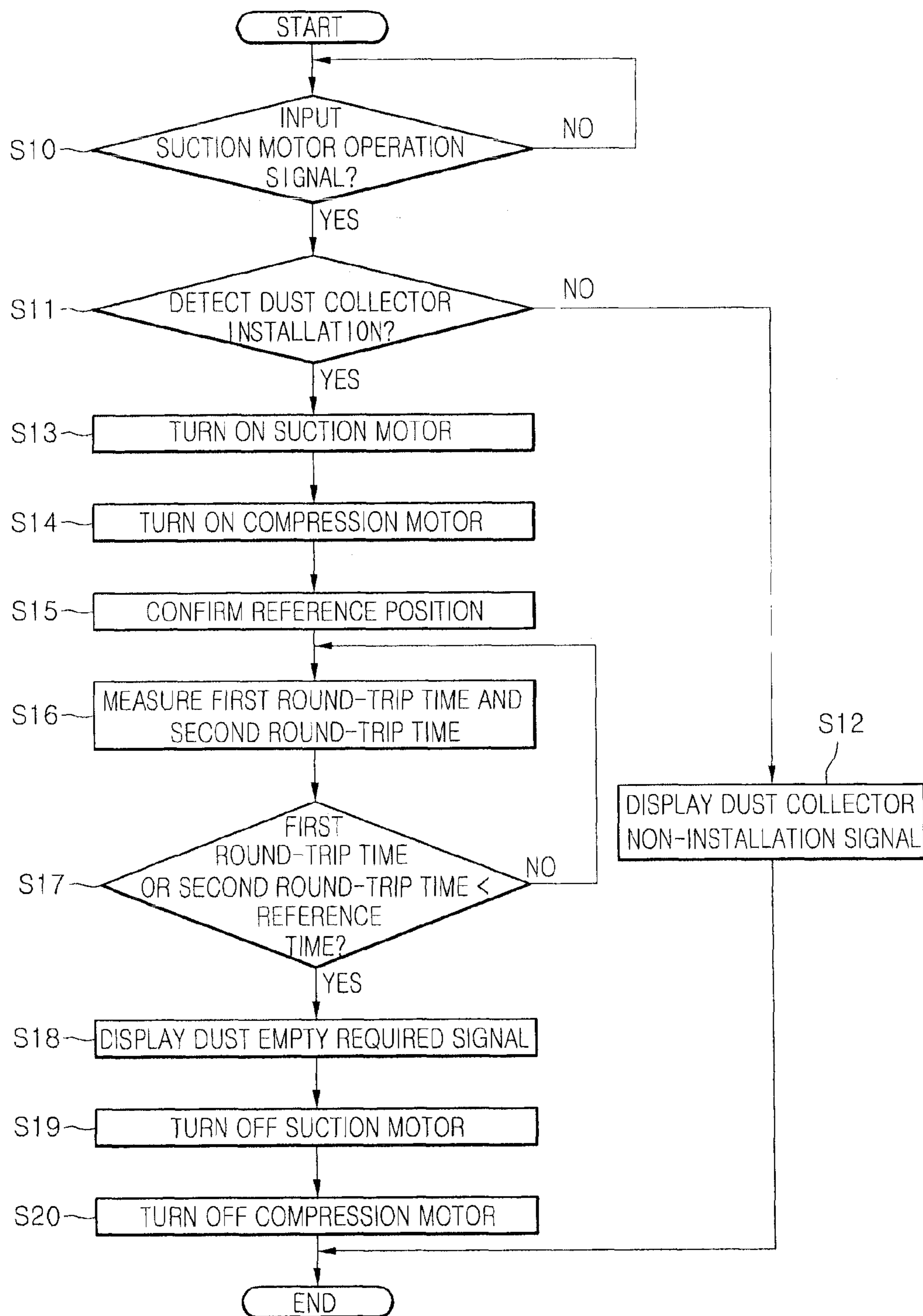


Fig. 28

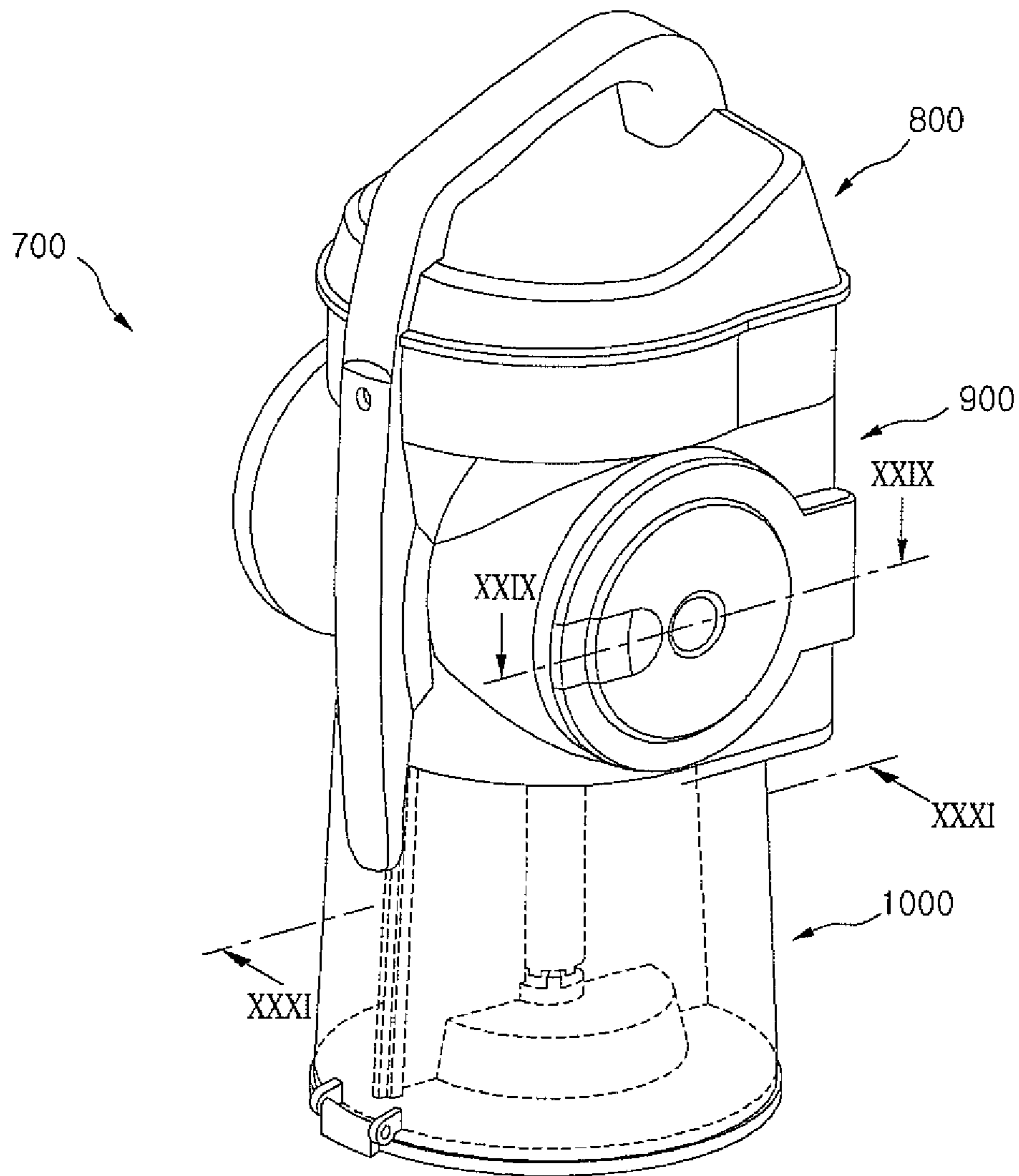


FIG. 29

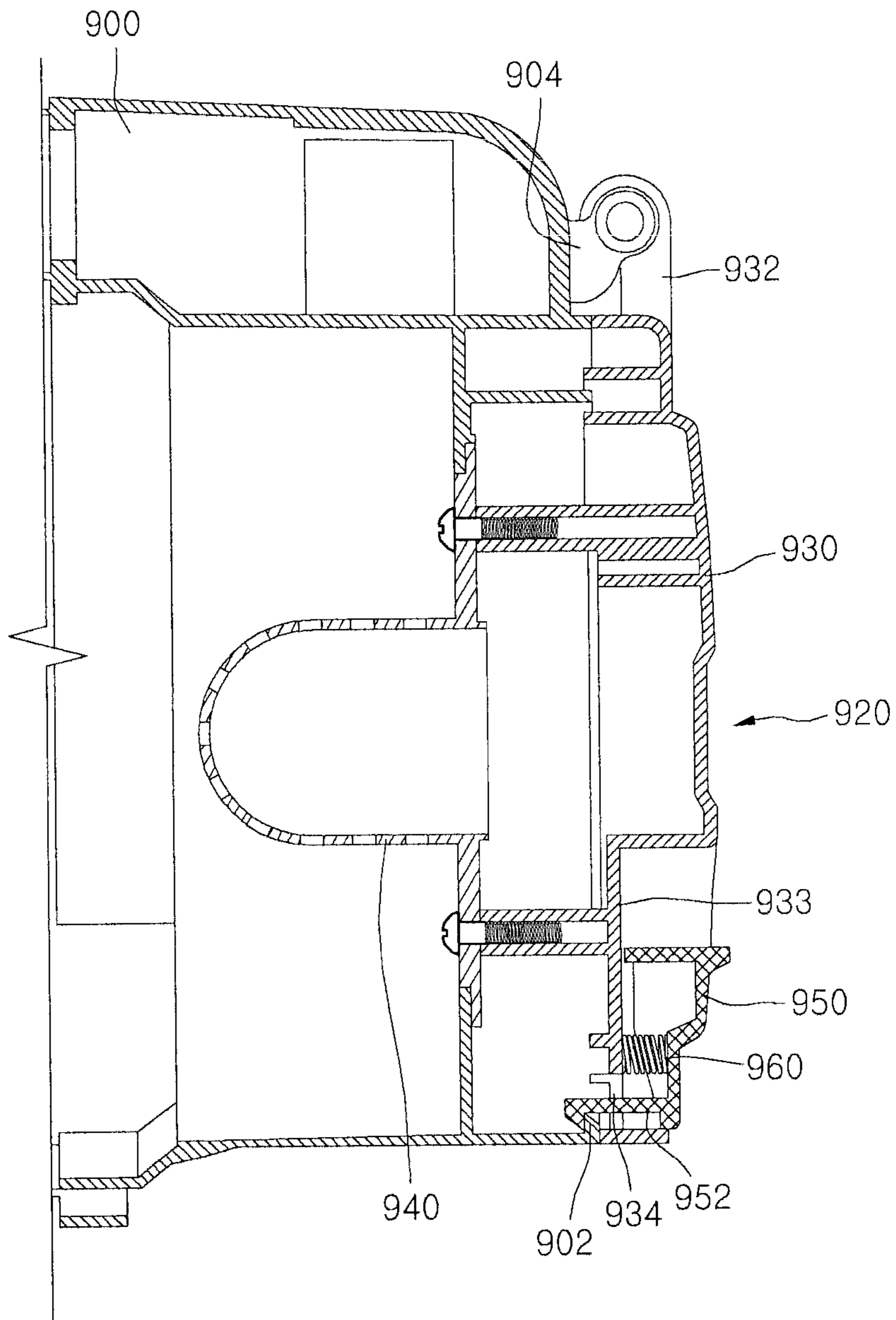


FIG. 30

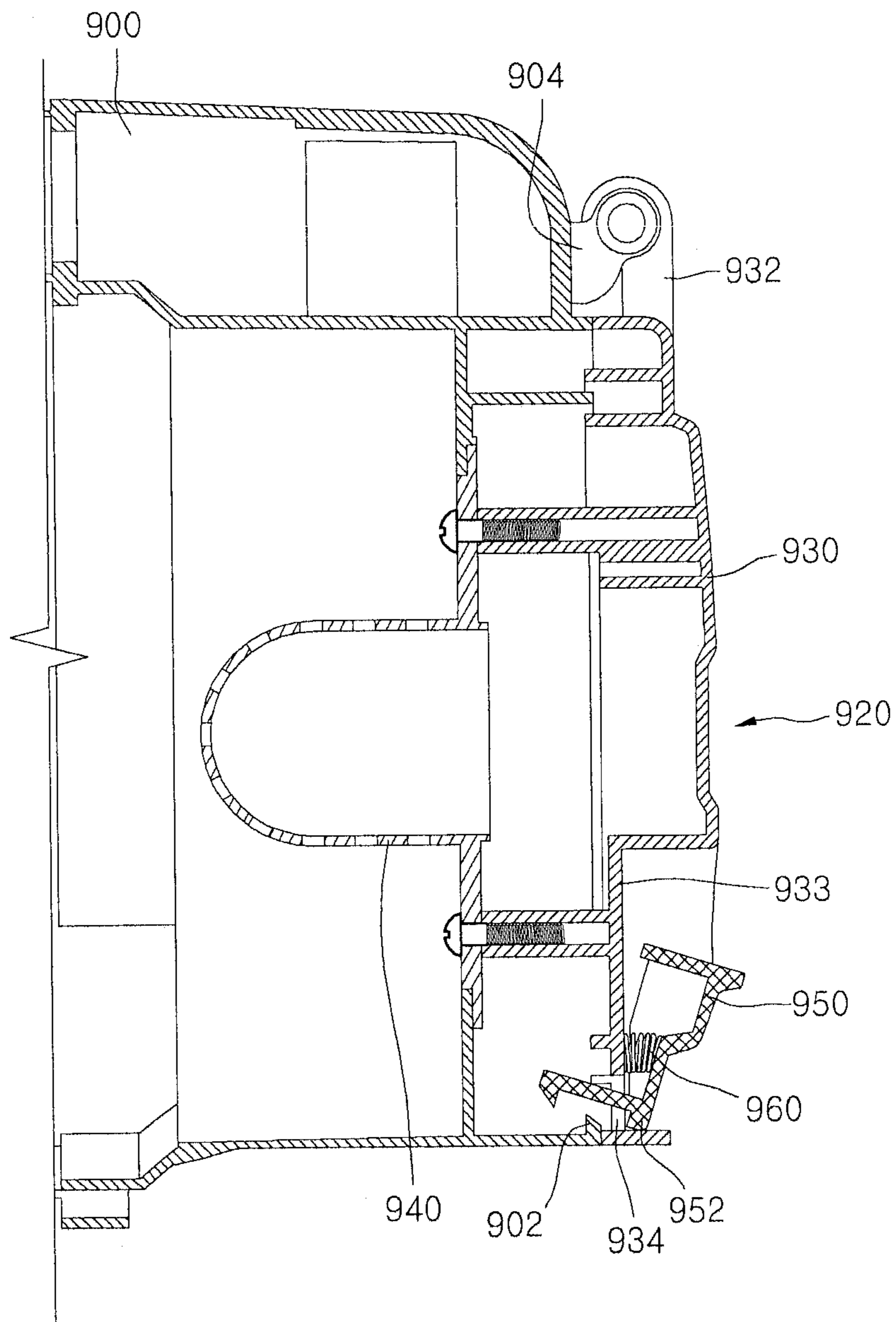


FIG. 31

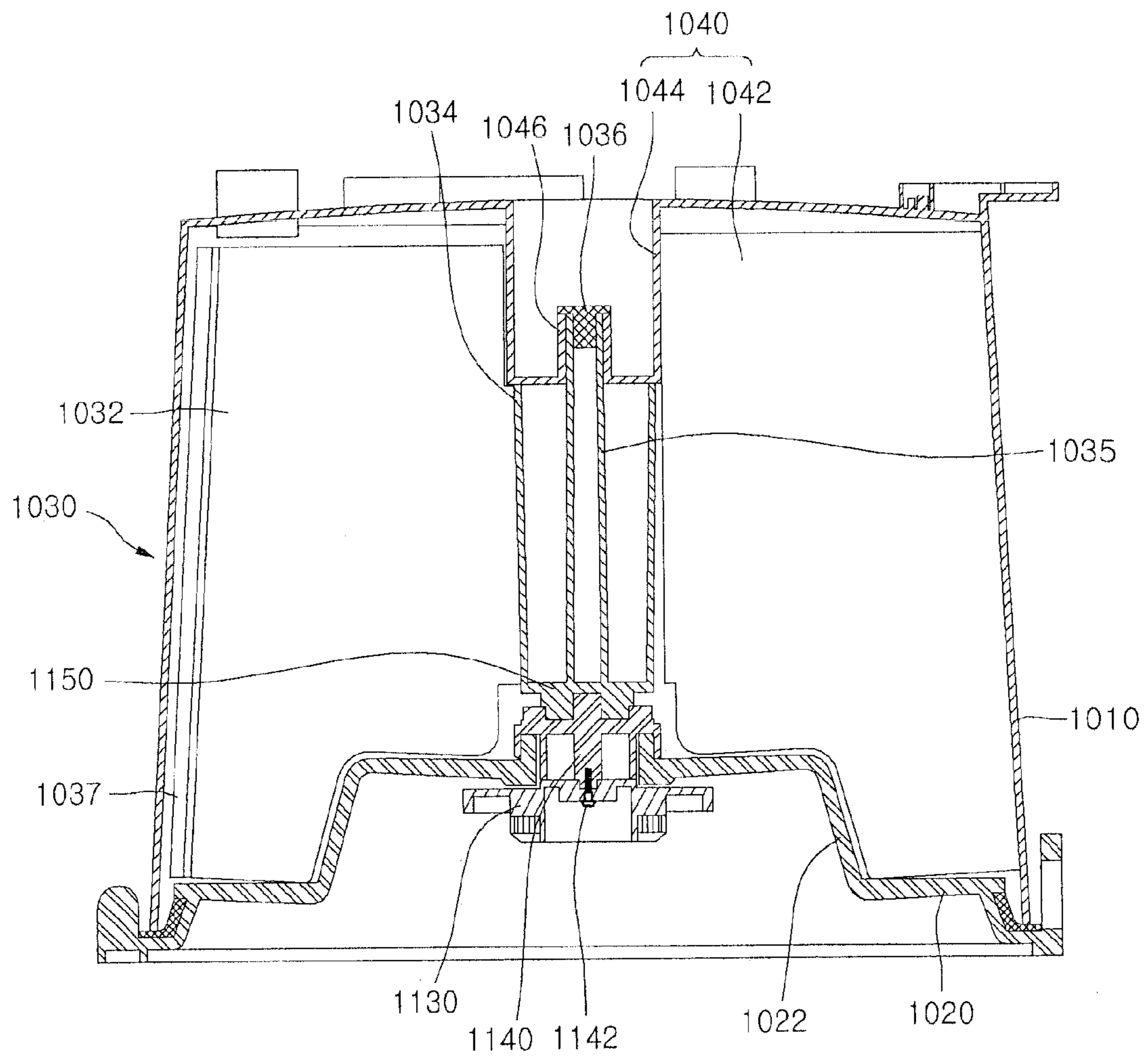


FIG. 32

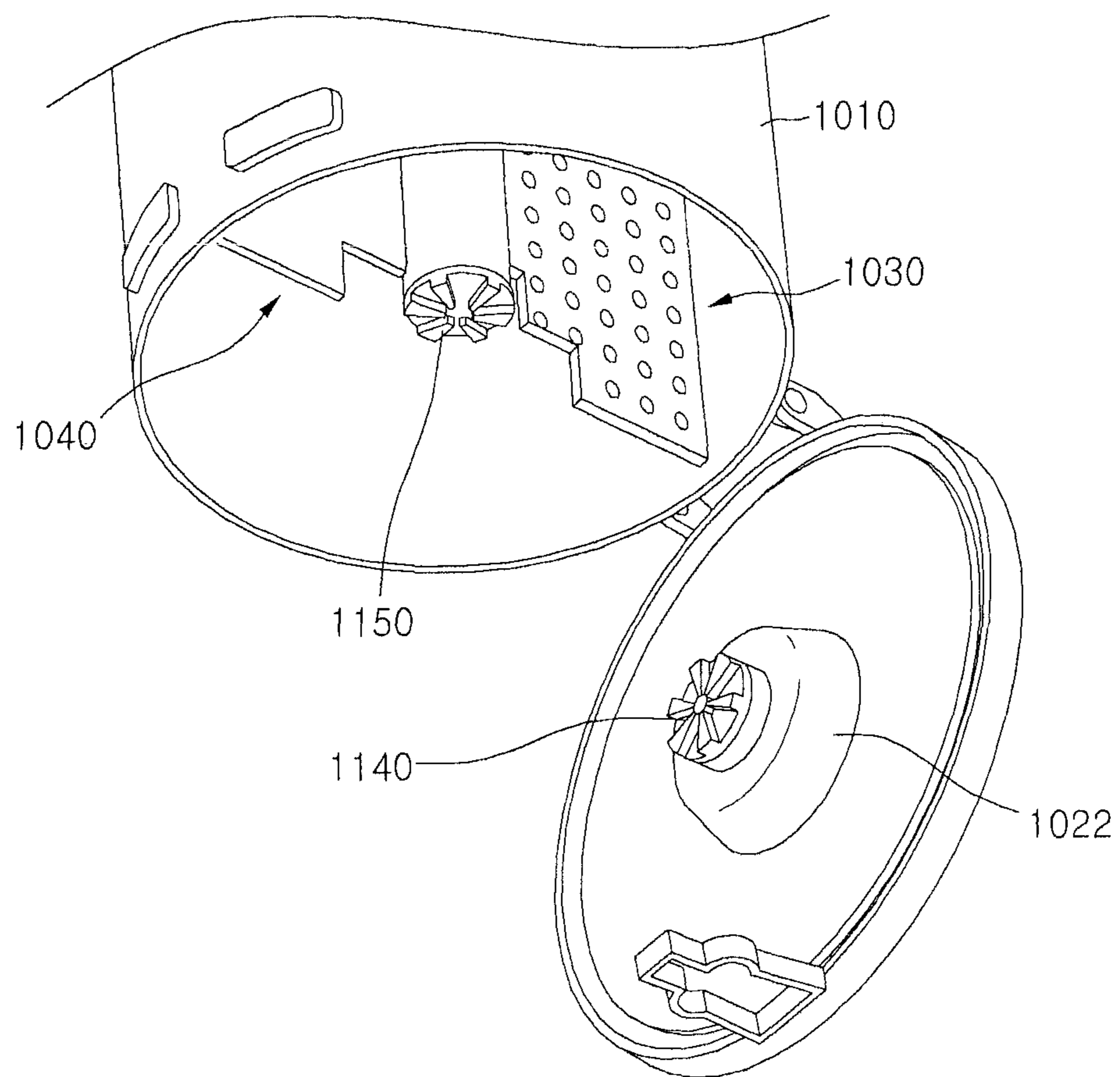


Fig. 33

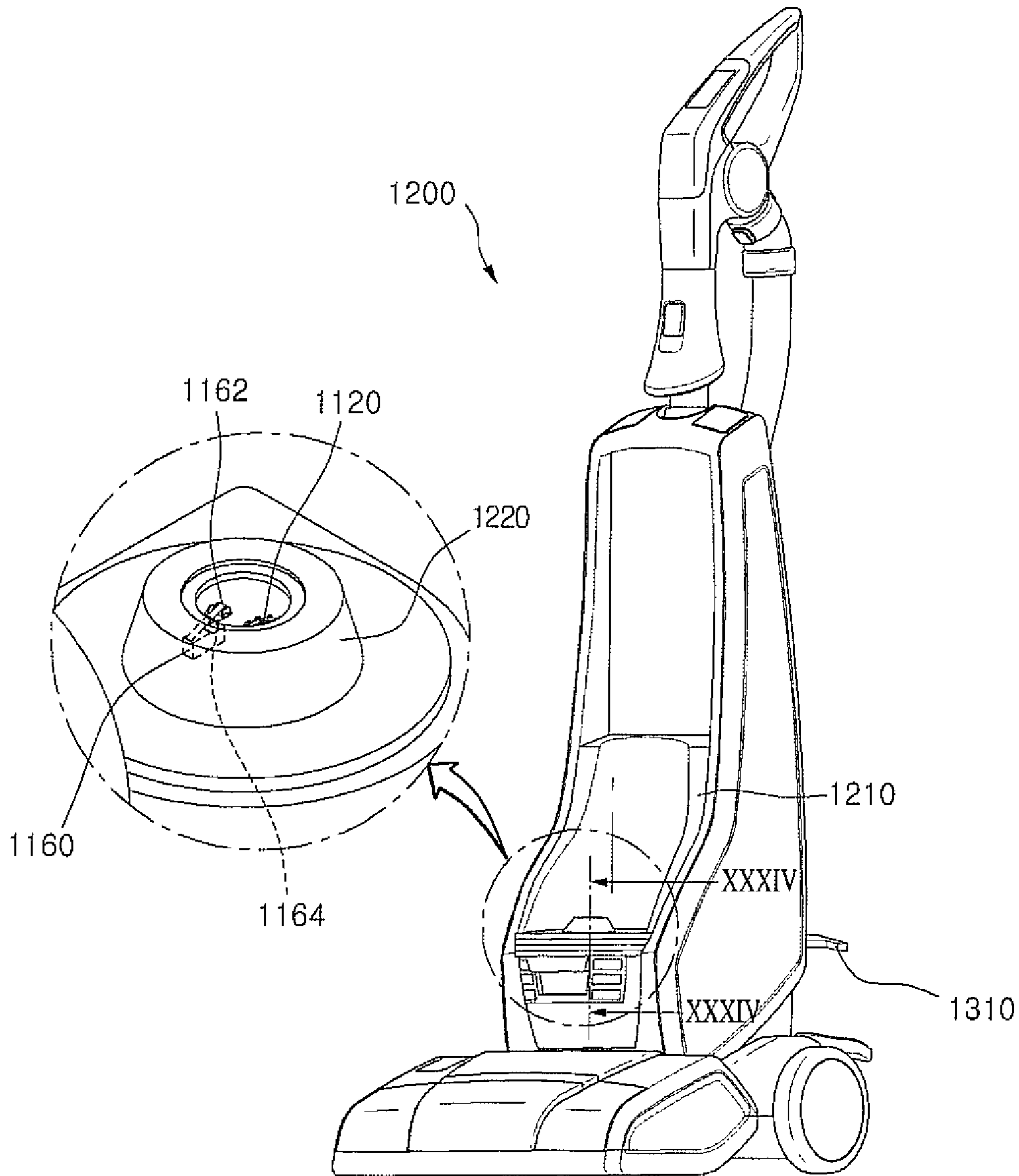


Fig. 34

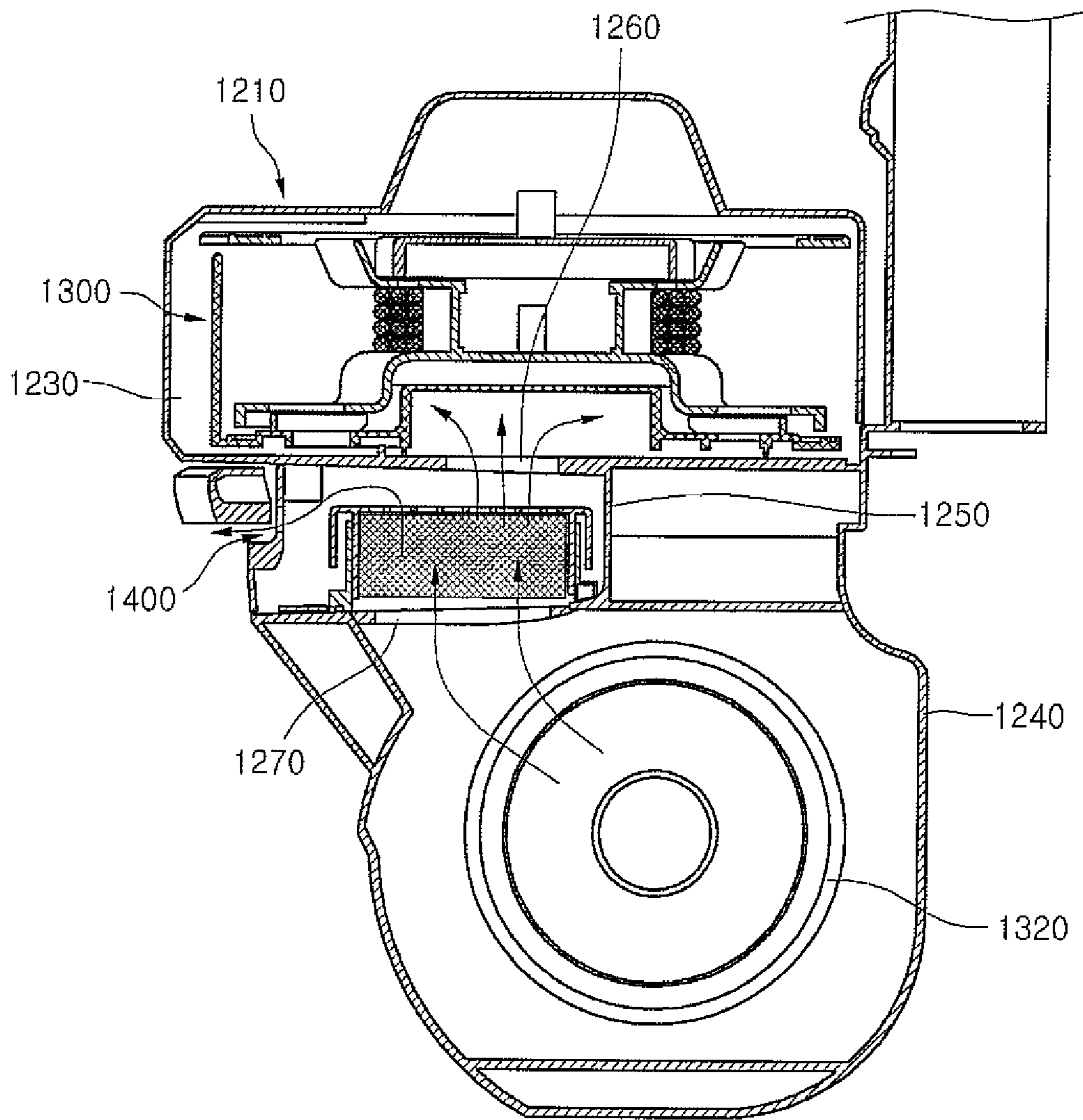


FIG. 35

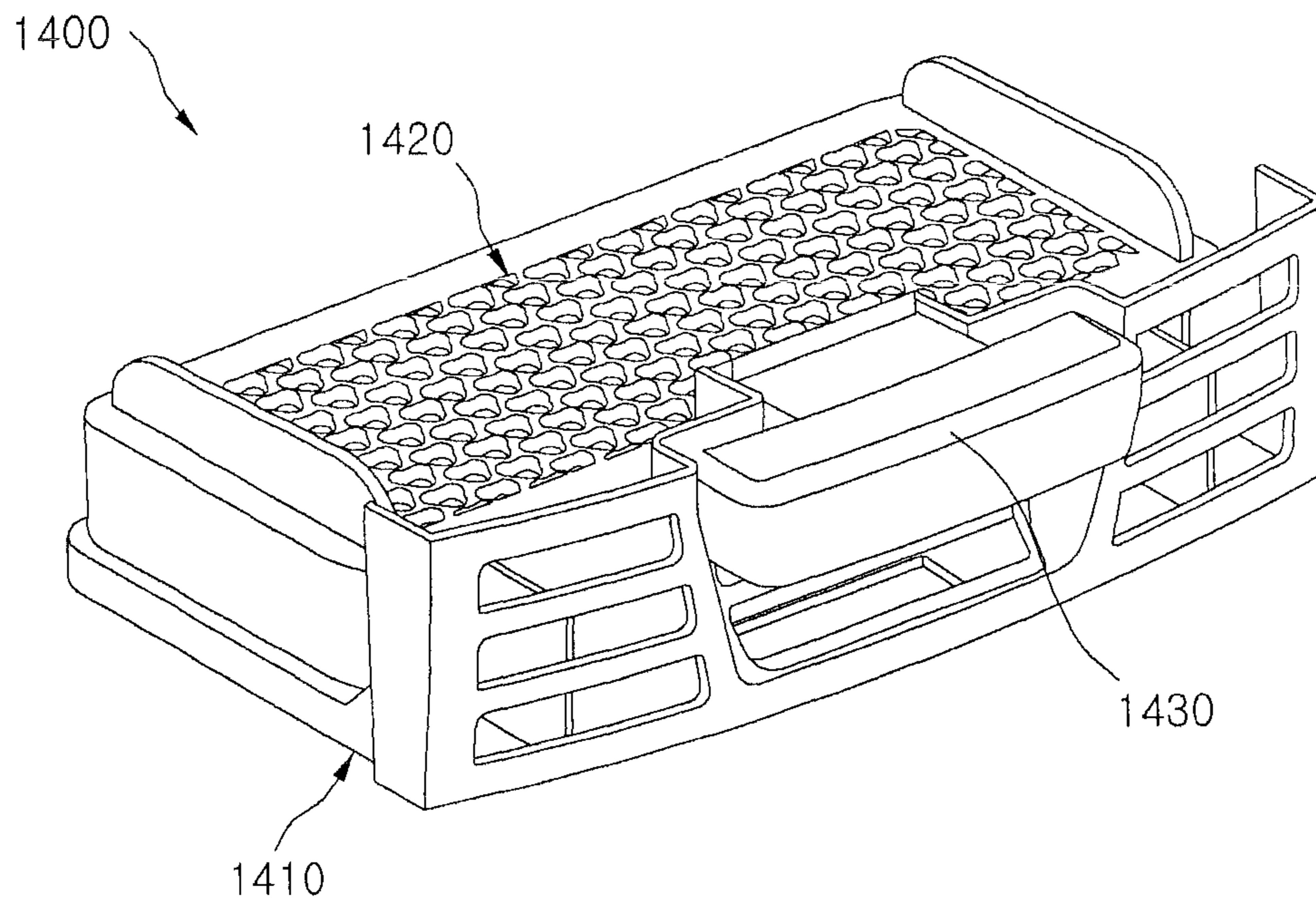


FIG. 36

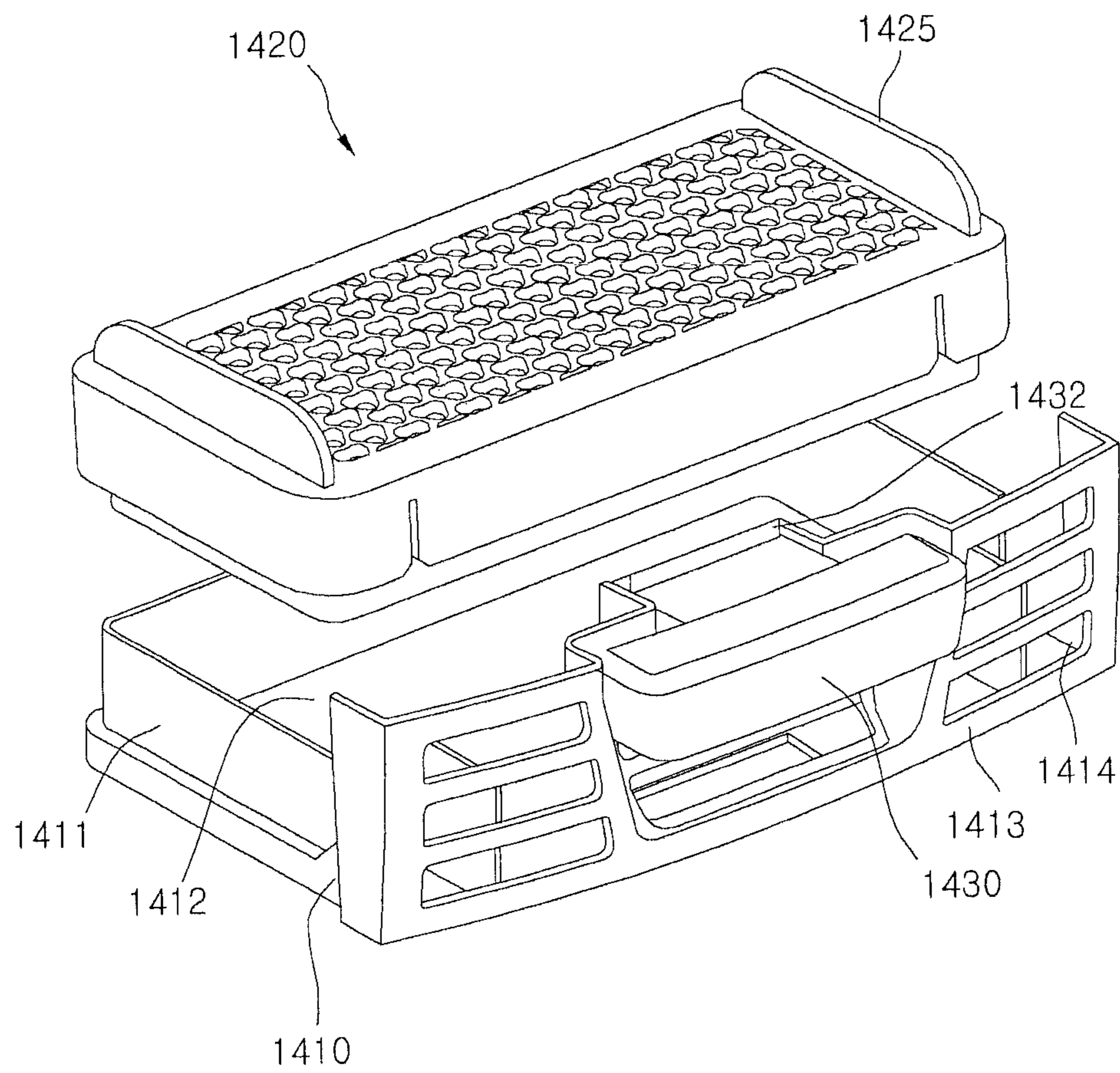


FIG. 37

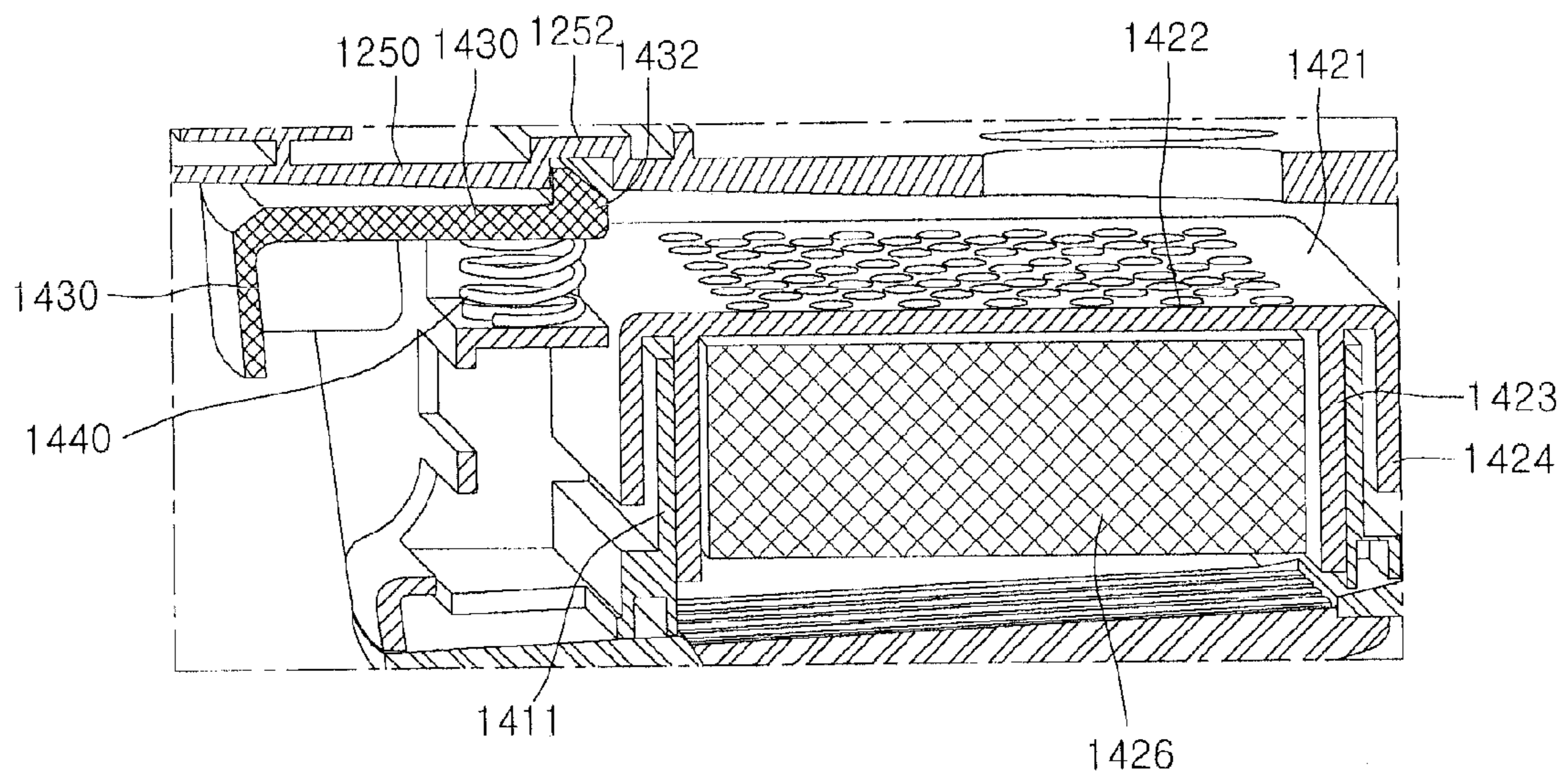
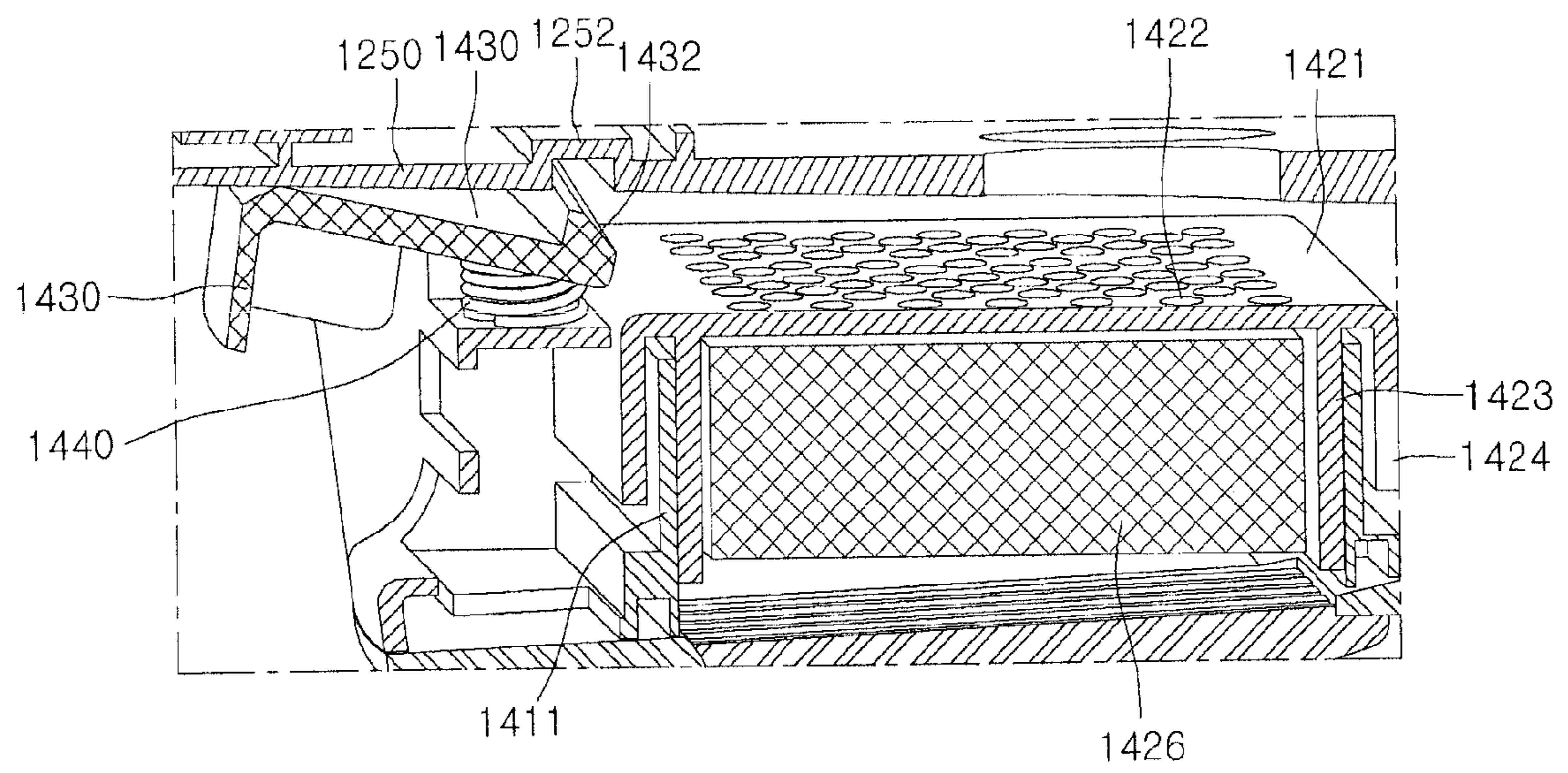


FIG. 38



VACUUM CLEANER

This application claims the benefit of U.S. Provisional Patent Application No. 61/151,982, filed on Feb. 12, 2009, which is hereby incorporated by reference in its entirety.

BACKGROUND

1. Field

A vacuum cleaner is disclosed herein.

2. Background

Vacuum cleaners are known. However, they suffer from various disadvantages.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements, and wherein:

FIG. 1 is a perspective view of a vacuum cleaner according to an embodiment;

FIG. 2 is a perspective view of the vacuum cleaner of FIG. 1 showing a dust separator separated therefrom;

FIG. 3 is a perspective view of the dust separator according to the embodiment of FIG. 1;

FIG. 4 is an exploded perspective view of the dust separator according to the embodiment of FIG. 1;

FIG. 5 is a perspective view of a dust separation device according to the embodiment of FIG. 1;

FIG. 6 is a partially exploded perspective view of the dust separation device according to the embodiment of FIG. 1;

FIG. 7 is a perspective view illustrating a lower side of an exhaust member according to the embodiment of FIG. 1;

FIG. 8 is a sectional view showing the exhaust member of FIG. 7 coupled to the dust separation device;

FIG. 9 is a sectional view illustrating an airflow within the dust separation device according to the embodiment of FIG. 1;

FIG. 10 is a perspective view showing a coupling member coupled to a cover member according to the embodiment of FIG. 1;

FIG. 11 is a perspective view of the cover member according to the embodiment of FIG. 1;

FIG. 12 is a perspective view of the coupling member according to the embodiment of FIG. 1;

FIG. 13 is a perspective view of a filter member according to the embodiment of FIG. 1;

FIG. 14 is a perspective view showing a state in which a filter device is rotated according to the embodiment of FIG. 1;

FIG. 15 is a perspective view of a cover member according to another embodiment;

FIG. 16 is an exploded perspective view of a dust container having a compression member according to the embodiment of FIG. 1;

FIG. 17 is a vertical sectional view of the dust container according to the embodiment of FIG. 1;

FIG. 18 is a perspective view showing a state in which a lower cover of the dust container is rotated according to the embodiment of FIG. 1;

FIG. 19 is a block diagram of a control structure of a vacuum cleaner according to the embodiment of FIG. 1;

FIGS. 20 and 21 are views illustrating a position relationship between a magnetic member and a second detector in a case in which a first compression member is close to one side of a second compression member;

FIGS. 22 and 23 are views illustrating a positional relationship between the magnetic member and the second detector in

a case in which the first compression member and the second compression member are disposed in a straight line;

FIGS. 24 and 25 are views illustrating a positional relationship between the magnetic member and the second detector in a case in which the first compression member is close to the other side of the second compression member;

FIG. 26 is a view illustrating a rotational operation of the first compression member of FIGS. 20 to 25;

FIG. 27 is a flowchart of a control method of a vacuum cleaner according to the embodiment of FIG. 1;

FIG. 28 is a perspective view of a dust separator according to another embodiment;

FIG. 29 is a sectional view taken along line XXIX-XXIX of FIG. 28;

FIG. 30 is a sectional view taken along line XXIX-XXIX of FIG. 28 in a state in which a coupling between a coupling member and a dust separation device is released;

FIG. 31 is a sectional view taken along line XXXI-XXXI of FIG. 28;

FIG. 32 is a perspective view of a dust container in a state in which a lower cover is open according to an embodiment;

FIG. 33 is a perspective view illustrating a main body of a vacuum cleaner according to another embodiment;

FIG. 34 is a sectional view taken along line XXXIV-XXXIV of FIG. 33;

FIG. 35 is a perspective view of an exhaust filter device according to another embodiment;

FIG. 36 is another perspective view of the exhaust filter device of FIG. 35; and

FIGS. 37 and 38 are views illustrating a mounting structure of the exhaust filter device of FIG. 36.

DETAILED DESCRIPTION

In the following detailed description, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific embodiments. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is understood that other embodiments may be utilized and that logical structural, mechanical, electrical, and chemical changes may be made without departing from the spirit or scope of the invention. To avoid detail not necessary to enable those skilled in the art to practice the invention, the description may omit certain information known to those skilled in the art. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the invention is defined only by the appended claims.

Generally, vacuum cleaners are devices that suck in air containing dust using a suction force generated by a suction motor installed inside a main body to filter the dust in a dust separator. Such a vacuum cleaner may be classified as a canister type, in which a suction nozzle that sucks in dust is separately provided from a main body and connected to the main body using a connection device, and an upright type, in which a suction nozzle is rotatably connected to a main body.

A related art vacuum cleaner may include a main body and a dust separator installed on or in the main body to store dust separated from air. The dust separator may be configured to separate the dust from the air using a cyclone principle. Thus, the dust separator may include a dust separation chamber. Also, the dust separator may include a filter member that filters the air separated from the dust in the dust separation chamber. The performance of the vacuum cleaner may be substantially determined according to a degree of dust separation performance.

3

FIG. 1 is a perspective view of a vacuum cleaner according to an embodiment, and FIG. 2 is a perspective view of the vacuum cleaner of FIG. 1 in a state in which a dust separator is separated therefrom. Although this embodiment shows a dust separator installed in an upright type vacuum cleaner; however, embodiments are not limited thereto. For example, the dust separator may be installed in a canister type vacuum cleaner.

Referring to FIGS. 1 and 2, a vacuum cleaner 1 according to this embodiment may include a main body 10, a suction nozzle 20, a dust separator 60, a suction tube 30, a handle 40, and a connection hose 50. A suction motor (not shown) that generates a suction force may be disposed in the main body 10. The suction nozzle 20 may be rotatably connected to a lower portion of the main body 10 and disposed on a floor or other surface. The dust separator 60 may be separably mounted on the main body 10. The suction tube 30 may be separably mounted on the main body 10. The handle 40 may be connected to the suction tube 30. The connection hose 50 may connect the handle 40 to the main body 10. Further, wheels 20 may be disposed on both sides of the suction nozzle 20 to allow a user to easily move the suction nozzle 20.

An operating lever 24 may be disposed on a rear side of the suction nozzle 20, so that the main body 10 may be rotated with respect to the suction nozzle 20 in an upright state. When the operating lever 24 is operated, the main body 10 may be rotated with respect to the suction nozzle 20. Then, a user may grasp the handle 40 in order to clean the floor or other surface while moving the suction nozzle 20.

The dust separator 60 may be separably mounted to a mounting part 11, which may be disposed at a front portion of the main body 10. The suction tube 30 may be separably mounted on a rear portion of the main body 10. The dust separator 60 may separate dust from air sucked into the main body 10 and store the separated dust.

The mounting part 11 may include a first detector 550 that detects mounting of the dust separator 60, and a second detector 560 that detects an amount of dust stored in the dust separator 60. The detectors 550 and 560 will be described hereinafter.

Hereinafter, a structure of the dust separator 60 will be described in more detail. FIG. 3 is a perspective view of the dust separator according to the embodiment of FIG. 1. FIG. 4 is an exploded perspective view of the dust separator according to the embodiment of FIG. 1. FIG. 5 is a perspective view of a dust separation device according to the embodiment of FIG. 1.

Referring to FIGS. 3 to 5, the dust separator 60 may include a dust separation device 100 that separates dust from sucked air, a dust container 200 in which the dust separated by the dust separation device 100 is stored, and an exhaust guide device 300 that guides an airflow of the air exhausted from the dust separation device 100. The dust separation device 100 may be coupled to an upper side of the dust container 200 and a lower side of the exhaust guide device 300.

A deco cover 360 may be coupled to the dust separation device 100. An inner deco 370 and an outer deco 380 may be coupled to the deco cover 360 and the dust container 200 in a state in which the dust container 200 is coupled to the dust separation device 100. The deco cover 360, the inner deco 370, and the outer deco 380 may improve an outer appearance of the dust separator 60.

The dust separation device 100 may include a cyclone device 110 that separates the dust from the air, a distribution device 120 that guides the air and the dust to the cyclone device 110, and a plurality of filter devices 130, which may be

4

rotatably coupled to the cyclone device 110, that filters the air from which the dust is separated.

The respective filter devices 130 may include a filter member 140, a cover member 150, a cover coupling part 160, a coupling member 170, an elastic member 190, and a shaft 180. The filter member 140 may be inserted into the cyclone device 110 from outside of the cyclone device 110. The cover member 150 may be coupled to the filter member 140. The cover coupling part 160 may be coupled to the cover member 150 to rotatably support the cover member 150. The coupling member 170 may be coupled to the cover member 150 to operate rotation of the cover member 150. The elastic member 190 may elastically support the coupling member 170. The shaft 180 may allow the cover member 150 to be rotatably connected to the cover coupling part 160.

The cover coupling part 160 may be coupled to the distribution device 120. Alternatively, the cover coupling part 160 may be integrated with the distribution device 120.

The filter member 140 may include a filter body 141 and an opening cover 143 that extends from an outer circumference of the filter body 141. The filter body 141 may selectively pass through an exhaust opening 116 defined in the cyclone device 110, and the opening cover 143 may selectively open and close the exhaust opening 116.

The dust container 200 may include a dust collector body 210, in which a dust storage part 214 may be disposed, and a lower cover 220 that covers a lower side of the dust collector body 210. For example, the dust collector body 210 may have a cylindrical shape and an open lower side; however, embodiment are not limited thereto.

A dust inlet 212, through which dust discharged from the dust separation device 100 may be introduced, may be defined in a top surface 211 of the dust collector body 210. Since the dust collector body 210 may be coupled to a lower portion of the dust separation device 100 and the dust inlet 212 defined in the top surface 211 of the dust collector body 210, the dust discharged from the dust separation device 100 may drop into the dust collection body 210.

The lower cover 220 may have one side connected to the dust collector body 210 by, for example, a hinge 222, and the other side selectively coupled to the dust collector body 210 by, for example, a coupling hook 224. When the lower cover 220 is rotated to open a lower opening of the dust collector body 210, the dust within the dust collector body 210 may be easily discharged.

A plurality of compression members 240 and 250 that compress the dust stored in the dust storage part 214 may be disposed in the dust collector body 210. The plurality of compression members 240 and 250 may include a first compression member 240 movably disposed in the dust storage part 214 and a second compression member 250 fixed to the dust storage part 214. In this embodiment, the first compression member 240 may be referred to as a moveable member, and the second compression member 250 may be referred to as a fixed member. The compression members 240 and 250 will be described in more detail later with reference to accompanying drawings.

The exhaust guide device 300 may include an exhaust member 330, an exhaust filter 340, a filter housing 350, a filter seat guide 320, and an upper cover 310. The exhaust member 330 may be coupled to an upper portion of the dust separation device 100. The exhaust filter 340 may be seated on the exhaust member 330 to filter the exhausted air. The filter housing 350 may protect the exhaust filter 340. The filter seat guide 320 may guide seating of the filter housing 350, to which the exhaust filter 340 may be coupled, and may be

5

coupled to the exhaust member 330. The upper cover 310 may be rotatably coupled to an upper portion of the exhaust member 330.

An air exhaust hole 311 that exhausts air may be defined in the upper cover 310. Air passing through the air exhaust hole 311 may be moved into the main body 10.

A handle part 312 may be disposed on the upper cover 310 to allow a user to easily grasp the upper cover 310. The handle part 312 may include a first coupling button 313 that fixes a position of the upper cover 310 and a second coupling button 314 coupled to the main body 10. The first coupling button 313 may be selectively coupled to the inner deco 370.

An exhaust passage 332, through which the air exhausted from the dust separation device 100 may flow, may be defined in the exhaust member 330. The air exhausted through the exhaust passage 332 may pass through the exhaust filter 340, and may then be exhausted through the air exhaust hole 311.

Hereinafter, a structure of each of component of the dust separation device 100 will be described in more detail.

FIG. 6 is a partially exploded perspective view of the dust separation device according to the embodiment of FIG. 6. Referring to FIGS. 4 to 6, the dust separation device 100 may include a first dust separator body 101 and a second dust separator body 102, which may be coupled to each other. The first dust separator body 101 may include a first cyclone body 111 that generates a first cyclone flow and a first distribution body 121, which may be integrated with the first cyclone body 111, that guides air to the first cyclone body 111. The second dust separator body 102 may include a second cyclone body 112 that generates a second cyclone flow and a second distribution body 122, which may be integrated with the second cyclone body 112, that guides air to the second cyclone body 112. The first cyclone body 111 and the second cyclone body 112 may constitute the cyclone device 110, and the first distribution body 121 and the second distribution body 122 may constitute the distribution device 120.

The respective cyclone bodies 111 and 112 may each include an air suction part 113. Thus, the cyclone device 110 may include a plurality of air suction parts 113.

A first dust discharge part 114 may be integrated with the first cyclone body 111, and a second dust discharge part 115 may be integrated with the second cyclone body 112. When the first cyclone body 111 and the second cyclone body 112 are coupled to each other, the first dust discharge part 114 and the second dust discharge part 115 may be coupled to each other to form a singular dust discharge part.

The singular dust discharge part may define a singular dust discharge passage. The respective dust discharge parts 114 and 115 may extend from the respective cyclone bodies 111 and 112 in a direction inclined to a cyclone flow axis (see reference symbol A of FIG. 6). The dust discharge parts 114 and 115 may be disposed at a central position of the cyclone device 110, and the air suction part 113 may be disposed on each of both sides of the dust discharge parts 114 and 115.

A suction hole 123 may be defined in any one of the first and second distribution bodies 121 and 122. A structure in which the suction hole 123 is defined in the first distribution body 121 is illustrated in FIG. 5 as an example.

The respective distribution bodies 121 and 122 may include flow guides 125 and 126 that guide air sucked in through the suction hole 123, such that the air flows toward the air suction part 113. That is, the air sucked into the distribution device 120 through the suction hole 123 may be branched to flow along the respective flow guides 125 and 126, and then may be moved to the respective air suction part 113.

6

One or more coupling boss(es) 124 coupled to the cover coupling part 160 may be disposed on a side surface of each of the distribution bodies 121 and 122. Further, at least portion of the respective cyclone bodies 111 and 112 may have, for example, a cylindrical or conic shape to generate a cyclone flow.

The first dust separator body 101 may have a first coupling surface 103, and the second dust separator body 102 may have a second coupling surface 104 that faces the first coupling surface 103. The exhaust opening 116 of the respective dust separator bodies 101 and 102 may be defined in a surface opposite to each of the respective coupling surfaces 103 and 104. Further, the first dust separator body 101 and the second dust separator body 102 may be coupled to each other in a direction of a cyclone flow axis A (or in a direction parallel to each other). That is, the first coupling surface 103 and the second coupling surface 104 may be inclined to the cyclone flow axis A, for example, substantially perpendicular to the cyclone flow axis A, and thus, the first coupling surface 103 and the second coupling surface 104 may be closely attached to each other in the direction of the cyclone flow axis A.

As described above, since the two dust separator bodies 101 and 102 may be coupled to each other in the direction of the cyclone flow axis A, the dust separation device 100 may be easily manufactured, and also, manufacturing costs may be reduced. In addition, a number of components may be reduced.

That is, when comparing manufacture of one complete dust separation device, in a case in which the dust separation bodies 101 and 102 having the same configuration as each other are separately manufactured, a number of molds for manufacturing the respective dust separation bodies 101 and 102 may be reduced, and also mold structures may be simplified. Thus, the dust separation device 100 may be easily manufactured, and costs for manufacturing the dust separation device 100 may be reduced. Also, since the respective dust separator bodies 101 and 102 may include the cyclone bodies 111 and 112 and the distribution bodies 121 and 122, a separate distribution body may not be required reducing the number of components.

A seat part 105 configured to seat a sealer (see reference symbol S in FIG. 9) may be disposed on any one of the first coupling surface 103 and the second coupling surface 104. A structure, in which the seat part 105 may be disposed on the first coupling surface 103 is illustrated in FIG. 6, as an example.

As described above, since the plurality of dust separator bodies 101 and 102 may be coupled to each other in the direction of the cyclone flow axis, an area for sealing and/or a length of the sealer may be reduced. That is, when compared to the case in which the plurality of dust separator bodies are coupled to each other in a direction perpendicular to the cyclone flow axis, in a case in which the plurality of dust separator bodies are coupled to each other in the direction of the cyclone flow axis, a contact area of the respective dust separator bodies 101 and 102 may be reduced, and also, the area for sealing and/or the length of the sealer may be reduced.

Also, since the singular dust discharge part may be disposed in the dust separation device, a structure of the dust separation device may be simplified. In addition, when compared to a case in which a plurality of dust discharge parts is disposed in the dust separation device, space utilization may be increased.

When the first cyclone body 111 and the second cyclone body 112 are coupled to each other, a singular cyclone chamber C may be defined. That is, the first cyclone body 111 may

define one portion of the cyclone chamber C, and the second cyclone body 112 may define the other portion of the cyclone chamber C.

The air suction part 113 may include a suction opening 113a that passes through the respective cyclone bodies 111 and 112 and a suction guide 113b that protrudes from the respective cyclone bodies 111 and 112. The suction guide 113b may define a lateral surface of a suction passage 113c that communicates with the distribution device 120. The suction passage 113c may be covered by the exhaust member 330 coupled to an upper portion of the dust separation device 100.

The exhaust opening 116, through which air may be exhausted, may be defined in a lateral surface of the respective cyclone bodies 111 and 112. An exhaust guide 117 that guides the air exhausted through the exhaust opening 116 may be disposed outside of the lateral surface of the respective cyclone bodies 111 and 112. The exhaust guide 117 and the respective distribution bodies 121 and 122 may define an air exhaust passage 118. The air exhaust passage 118 may communicate with the exhaust passage 332 of the exhaust member 330.

A coupling part 119, which may be coupled to a coupling hook (see reference numeral 172 of FIG. 12) of a coupling member, will be described later and may be disposed on the respective cyclone bodies 111 and 112.

FIG. 7 is a perspective view illustrating a lower side of an exhaust member according to the embodiment of FIG. 1, and FIG. 8 is a sectional view of a state in which the exhaust member of FIG. 7 is coupled to the dust separation device. A vertical sectional view of the first dust separator body is illustrated in FIG. 8, as an example. Since the first dust separator body and the second dust separator body may have the same configuration, the configuration of only the first dust separator body will be described herein below.

Referring to FIGS. 5 to 8, a plurality of coupling holes 331, through which a coupling member coupled to the dust separation device 100 may pass, may be defined in the exhaust member 330. A hinge part 338, which may be coupled to the upper cover 310, may be disposed on a rear side of the exhaust member 330.

Further, a plurality of exhaust passages 332, through which the air within the air exhaust passage 118 may pass, may be defined in the exhaust member 330. A passage formation part 333 that defines a portion of the suction passage 113c may be disposed between the plurality of exhaust passages 332. The passage formation part 333 may define a top surface of the suction passage 113c.

The passage formation part 333 may include a middle portion 334, a first guide portion 335 disposed at a rear side of the middle portion 334 with respect to an air suction direction, and a second guide portion 336 disposed at a front side of the middle portion 334 with respect to the air suction direction. That is, air may sequentially flow along the second guide portion 336, the middle portion 334, and the first guide portion 335, and then may be introduced into the cyclone chamber C through the suction opening 113a. The passage formation part 333 may have, for example, a rounded shape as a whole, or at least one surface of the passage formation part 333 may be flat.

As shown in FIG. 8, the flow guide 125 of the first distribution body 121 and an outer surface of the first cyclone body 111 may define a connection passage 127, through which the suction hole 123 may communicate with the suction passage 113c. Thus, at least a portion of the air sucked through the suction hole 123 may flow along the outer surface of the first cyclone body 111.

A bottom surface of the passage formation part 333, an inner surface of the flow guide 125, and an inner circumference of the cyclone chamber C may form a continuously curved surface in a state in which the exhaust member 330 is coupled to the dust separation device 100, such that air and dust smoothly flow along the insides of the connection passage 127 and the suction passage 113c. Thus, since the air and dust flow along the inner surface of the flow guide 125 and the bottom surface of the passage formation part 333, and then the air and dust flow along the inner circumference of the cyclone chamber C, cyclone flow may be easily generated within the cyclone chamber C. That is, since the air and dust flow into the cyclone chamber C in a state in which a centrifugal force is applied to the air and dust flowing along the inner surface of the flow guide 125 and the bottom surface of the passage formation part 333, the air and dust may smoothly flow along the inner circumference of the cyclone chamber C.

In this embodiment, since the connection passage 127 and the suction passage 113c guide the air and dust to the suction opening 113a, the connection passage 127 and the suction passage 113c may be called guide passages, respectively. Thus, the passage formation part 333 may define a portion of the guide passage.

Hereinafter, an effect of the dust separator according to this embodiment will be described.

FIG. 9 is a sectional view illustrating an airflow within the dust separation device according to the embodiment of FIG. 1. Referring to FIGS. 1 to 9, when a suction force is generated by the suction motor disposed within the main body 10, air containing dust may be sucked through the suction nozzle 20. The sucked air may be introduced into the main body 10, and then exhausted to the dust separator 60.

The air exhausted from the main body 10 may be sucked into the distribution device 120 through the suction hole 123. The air sucked into the distribution device 120 may be branched into each of the connection passages 127, and then sucked into the cyclone device 110 through the respective suction openings 113a.

Thus, a plurality of cyclone flows may be generated within the singular cyclone chamber C disposed within the cyclone device 110. That is, a first cyclone flow may be generated within the first cyclone body 111, and a second cyclone flow may be generated within the second cyclone body 112.

The sucked air circularly may flow along the inner circumference of the cyclone device 110 and may be concentrated at a central portion of the cyclone device 110. With this process, the air and dust may be separated from each other because different centrifugal forces may be respectively applied to the air and dust due to weight difference.

As described above, since the plurality of cyclone flows may be generated within the singular cyclone chamber C, an flow passage area of the air may increase, and thus, passage losses of air may be reduced to improve dust separation performance. Also, as the plurality of cyclone flows may be generated within the singular cyclone chamber C, the cyclone device 110 may decrease in size when compared to a structure in which one cyclone flow is generated.

Also, as the plurality of cyclone flows may be generated within the singular cyclone chamber C, dust separation performance similar to that of a structure in which air sequentially flows along a plurality of cyclone devices may be obtained. Thus, an additional cyclone device that re-separates the dust from the air exhausted from the cyclone device is not required. However, in this embodiment, additional cyclone devices may be further provided.

The separated dust (dotted lines in FIG. 9) may be discharged from the central portion of the cyclone device 110 to

the dust discharge parts **114** and **115**. Thereafter, the dust may flow within the dust discharge parts **114** and **115**, and may then drop into the dust container **200**.

On the other hand, the air (straight lines in FIG. 9) from which the dust may be separated may be filtered while passing through one or more holes **142** of the respective filter member **140**. Then, the air may flow into the air exhaust passage **118** through the exhaust opening **116**. The air within the respective air exhaust passages **118** may flow along the exhaust passage **332** of the exhaust member **330**, and then may be exhausted from the dust separator **60** through the air exhaust hole **311**.

FIG. 10 is a perspective view showing a coupling member coupled to a cover member according to the embodiment of FIG. 1. FIG. 11 is a perspective view of the cover member according to the embodiment of FIG. 1. FIG. 12 is a perspective view of the coupling member according to the embodiment of FIG. 1.

Referring to FIGS. 4, and 10 to 12, the cover member **150** may be rotated in a state in which it is coupled to the cover coupling part **160**. The cover member **150** may cover a side of the exhaust guide **117**.

A plurality of coupling bosses **154**, which may be coupled to the filter member **140** by coupling members, may be disposed on the cover member **150**. Also, a plurality of rotation guides **151** and **152** configured to rotate the cover member **150** may be disposed on the cover member **150**. The plurality of rotation guides **151** and **152** may be vertically spaced from each other, as shown in FIG. 11. An insertion hole **153**, in which a shaft **180** may be inserted, may be defined in each of the rotation guides **151** and **152**. One portion of the shaft **180** may be coupled to the cover coupling part **160**, and the other portion of the shaft **180** may pass through the insertion hole **153** of each of the plurality of rotation guides **151** and **152** and be coupled to the plurality of rotation guides **151** and **152**.

The cover member **150** may include a coupling part **155**, to which a fastening member, for example, a screw, may be attached, that prevents an elastic member **190** from being separated in a state in which the elastic member **190** is seated, and a support rib **158** that supports the elastic member **190**.

The cover member **150** may have a through-hole **156** through which the coupling hook **172** of the coupling member **170** may pass, and a guide hole **157**, to which a guide hook **173** of the coupling member **170** may be coupled.

The coupling hook **172** may be elastically supported by the elastic member **190** in a state in which the coupling hook **172** passes through the through-hole **156**. For example, a leaf spring may be used as the elastic member to increase space utilization. The elastic member **190** may apply a force to the coupling hook **172** in a direction in which the coupling hook **172** is inserted into the coupling part **119**. The through-hole **156** and the guide hole **157** may have horizontal lengths greater than those of the coupling hook **172** and the guide hook **173**, such that the coupling hook **172** and the guide hook **173** may be moved in left and right direction with respect to the cover member **150** in a state in which the coupling hook **172** and the guide hook **173** pass through the through-hole **156** and the guide hole **157**.

The coupling member **170** may include the coupling hook **172** and the plurality of guide hooks **173**. The respective guide hooks **173** may be disposed spaced apart from an upper side and a lower side of the coupling hook **172**, respectively.

FIG. 13 is a perspective view of a filter member according to the embodiment of FIG. 1. Referring to FIGS. 4, and 10 to 13, the filter member **140** may include a filter body **141**, an opening cover **143**, and a flow guide **145**. A plurality of holes

142, through which air may pass, may be defined in the filter body **141**. The opening cover **143** may extend from an outer surface of the filter body **141** to selectively cover the exhaust opening **116**. The flow guide **145** may guide a flow of the air passing through the holes **142**.

The filter body **141** may pass through the exhaust opening **116** and may be selectively inserted into the cyclone chamber C. At least portion of the filter body **141** may have a cylindrical shape.

The filter body **141** may be selectively inserted into the cyclone chamber C for easy cleaning of the inside of the cyclone chamber C and the filter body **141**. That is, when the cover member **150**, to which the filter member **140** may be coupled, is rotated, the filter body **141** may be withdrawn to the outside of the cyclone chamber C. Thus, a user may easily clean the filter body **141** or the inside of the cyclone chamber C.

A plurality of coupling holes **144**, through which a coupling member to be coupled to the cover member **150** may pass, may be defined in the opening cover **143**. At least portion of the flow guide **145** may have a cylindrical shape, and a flow hole **146**, through which the air passing through the filter body **141** may pass, may be defined in the flow guide **145**.

FIG. 14 is a perspective view showing a state in which a filter device is rotated according to the embodiment of FIG. 1. Referring to FIGS. 9 to 14, when the dust separation process is performed in the cyclone device **110**, hairs may be wound on the filter body **141** or dust may block the holes **142** of the filter bodies **141**. In such a case, since the air does not smoothly pass through the filter body **141**, the dust separation performance may be reduced. As a result, cleaning of the filter body **141** may be required.

In this embodiment, since the plurality of filter bodies **141** may be disposed within the cyclone device **110**, even if dust blocks one of the filter bodies, the air may pass through the other filter bodies. Thus, according to this embodiment, the dust separation performance may be prevented from being significantly reduced when compared to when only one filter body is provided.

Also, when dust having a large volume is held in the inside or at inlets of the dust discharge parts **114** and **115**, since the dust is not discharged, cleaning of the dust discharge parts **114** and **115** may be required. To clean the inside of the cyclone device **110** or the filter body **141**, the user may first operate the coupling member **170**. As a result, the coupling hook **172** of the coupling member **170** is separated from the coupling part **119** of the cyclone device **110**. Also, the cover member **150** coupled to the filter member **140** may be rotated. When the cover member **150** is rotated, the filter body **141** disposed inside the cyclone device **110** may be withdrawn to the outside of the cyclone device **110**. When the filter body **141** is withdrawn to the outside of the cyclone device **110**, the user may clean the filter body **141** or the inside of the cyclone device **110**.

According to this embodiment, when the filter member **140** is rotated, the filter body **141** is withdrawn to the outside of the cyclone device **110**, and simultaneously, the exhaust opening **116** is opened. Thus, the filter body **141** or the inside of the cyclone device **110** may be cleaned without dismantling the cyclone device **110**.

FIG. 15 is a perspective view of a cover member according to another embodiment. This embodiment is similar to the previous embodiment except for a structure of a rotation guide that guides rotation of a cover member. Thus, repetitive description has been omitted.

11

Referring to FIG. 15, a cover member 650 according to this embodiment may include a plurality of rotation guides 651 and 652. The plurality of rotation guides 651 and 652 may include a first guide 651 and a second guide 652, which may be vertically spaced from each other. A portion of each of the guides 651 and 652 connected to the cover member 650 may have a thickness less than a thickness of the other portions thereof. Thus, the guides 651 and 652 may be elastically moved with respect to the cover member 650.

Hinge shafts 653 may protrude from the guides 651 and 652 in direction away from each other, respectively. That is, the hinge shaft 653 of the first guide 651 may protrude upwardly, and the hinge shaft 653 of the second guide 652 may protrude downwardly. A shaft insertion hole (not shown), in which the respective hinge shafts 653 may be inserted, may be defined in the cover coupling part (see reference numeral 160 of FIG. 4) to support the cover member 650. According to this embodiment, since the hinge shafts 653 are integrated with the cover member 650, a separate hinge shaft may not be required, simplifying a structure of the cover member 650.

FIG. 16 is a partially exploded perspective view of a dust container having a compression member according to the embodiment of FIG. 1. FIG. 17 is a vertical sectional view of the dust container according to the embodiment of FIG. 1. FIG. 18 is a perspective view showing a state in which a lower cover of the dust container is rotated according to the embodiment of FIG. 1.

Referring to FIGS. 2, 4 and 16 to 18, the first compression member 240 may include a rotation shaft 244 and a first compression plate 242, which may be integrated with the rotation shaft 244, configured to compress the dust. The second compression member 250 may include a fixed shaft 254 coupled to the rotation shaft 244 and a second compression plate 252, which may be integrated with the fixed shaft 254. The dust stored in the dust storage part 214 may be compressed by an interaction between the first compression plate 242 and the second compression plate 252.

That is, the first compression plate 242 may be moved toward one side of the second compression plate 252 to compress the dust disposed between one side of the second compression plate 252 and the first compression plate 242. Also, the first compression plate 242 may be moved toward the other side of the second compression plate 252 to compress the dust disposed between the other side of the second compression plate 252 and the first compression plate 242.

The fixed shaft 254 may be integrated with a top surface 211 of the dust collector body 210 and/or an inner circumference of the dust collector body 210. A coupling boss 256 may protrude downwardly from the fixed shaft 254. An insertion part 245, in which the coupling boss 256 may be inserted, may be disposed on the rotation shaft 244. A coupling member 480 may be coupled to the coupling boss 256 in a state in which the coupling boss 256 is inserted into the insertion part 245.

The first compression member 240 may be automatically moved by a driving device. The driving device may include a driving source that drives the first compression member 240 and a power transmission that transmits power of the driving source to the first compression member 240.

For example, a compression motor (see reference numeral 410 of FIG. 19) may be used as the driving source. The power transmission may include a main body transfer part 420 (see FIG. 2) coupled to the compression motor (see reference numeral 410 of FIG. 19) and disposed in the main body 10 and a transfer device selectively connected to the main body transfer part 420.

12

The transfer device may include a first transfer part 430, a second transfer part 440, a fixed part 450, a connection part 460, and an elastic member 470. The first transfer part 430 may be disposed below the lower cover 220. The second transfer part 440 may be disposed above the lower cover 220 and rotated together with the first transfer part 430. The fixed part 450 may be disposed on the second transfer part 440 and coupled to the first transfer part 430. The connection part 460 may be coupled to the rotation shaft 244 of the first compression member 240 and selectively connected to the fixed part 450. The elastic member 470 may be disposed on the first transfer part 430 to elastically support the second transfer part 440.

In more detail, the compression motor (see reference numeral 410 of FIG. 19) may be disposed inside the main body 10, and a portion of the main body transfer part 420 may be exposed from the mounting part 11 in a state in which the main body transfer part 420 is coupled to the compression motor (see reference numeral 410 of FIG. 19). When the dust container 200 is mounted on the mounting part 11, the main body transfer part 420 may be connected to the first transfer part 430. For example, a gear may be used as each of the main body transfer part 420 and the first transfer part 430.

The first transfer part 430 may include a gear body 431, a plurality of gear teeth 432, a magnetic member 435, and a gear cover 436. The plurality of gear teeth 432 may be disposed along a circumferential surface of the gear body 431. The magnetic member 435 may be received into a lower side of the gear body 431. The gear cover 436 may be coupled to a lower portion of the gear body 431 to cover the magnetic member 435.

The magnetic member 435 may have a rectangular bar shape. A seat part 437, on which the magnetic member 435 may be seated and having a shape corresponding to that of the magnetic member 435, may be disposed on the gear cover 436. The seat part 437 may extend from a central portion of the gear cover 436 in a radius or radial direction. A guide rib 438 that guides the seating of the magnetic member 435 may be disposed on a portion of a circumference of the seat part 437. A plurality of hooks 439, which may be coupled to the gear body 431, may be disposed on or along a circumference of the gear cover 436.

The plurality of hooks 439 may be arranged different distances apart from each other, and the gear cover 436 may be coupled to the gear body 431 at a predetermined position in a state in which the magnetic member 435 is seated on the gear cover 436. Hook coupling holes 434, to which the plurality of hooks 439 may be coupled, may be defined in the gear body 431. Also, a guide rib 433 that guides a coupling of the fixed part 450 may be disposed on a top surface of the gear body 431.

The gear cover 436 may be coupled to a lower portion of the gear body 431 in a state in which the magnetic member 435 is seated on the gear cover 436. Thus, when the gear body 431 is rotated, the magnetic member 435 may be rotated together with the gear body 431.

A portion of the gear body 431 may pass through an opening 225 defined in a central portion of the lower cover 220. Further, a rotation guide 226 that guides the rotation of the gear body 431 passing through the opening 225 may be disposed on a top surface of the lower cover 220.

A hole 442, in which a portion of the fixed part 450 may be inserted, may be defined in a central portion of the second transfer part 440. A first guide part 443 and a second guide part 444, which may be selectively inserted into the connection part 460, may protrude from a top surface of the second transfer part 440. A distance from the hole 442 to the first

guide part **443** may be different from a distance from hole **442** to the second guide part **444**. This specifies connection positions between the guide parts **443** and **444** and the connection part **460**.

An insertion protrusion **452**, which may be inserted into the connection part **460**, may be disposed on a central portion of the fixed part **450**. A first through-hole **453** and a second through-hole **454**, through which the guide parts **443** and **444** may respectively pass, may be defined in the fixed part **450**.

A distance between the insertion protrusion **452** and the first through-hole **453** may be equal to a distance between the hole **442** and the first guide part **443**. A distance between the insertion protrusion **452** and the second through-hole **454** may be equal to a distance between the hole **442** and the second guide part **444**.

A seat groove **455** on which the guide rib **433** of the gear body **431** may be seated, may be defined in a lower portion of the fixed part **450**. The fixed part **450** may be coupled to the gear body **431** by a coupling member **490** in a state in which the respective guide parts **443** and **444** pass through the respective through-holes **453** and **454**, respectively. When the fixed part **450** is coupled to the gear body **431**, the second transfer part **440** may be supported by the elastic member **470** to allow the second transfer part **440** to be vertically moved.

The connection part **460** may be coupled to a lower portion of the rotation shaft **244**. A hook **461** may be disposed on the connection part **460**. A hook insertion hole **246**, in which the hook **461** may be inserted, may be defined in the rotation shaft **244**.

The connection part **460** may include a protrusion receiving part **462**, in which the insertion protrusion **452** may be inserted, a first receiving part **463**, and a second receiving part **464**. The guide parts **443** and **444** may be inserted into the first receiving part **463** and the second receiving part **464**, respectively.

A distance between the protrusion receiving part **462** and the first receiving part **463** may be equal to a distance between the hole **442** and the first guide part **443**. A distance between the protrusion part **462** and the second receiving part **464** may be equal to a distance between the hole **442** and the second guide part **444**. Thus, the first guide part **443** may be received into the first receiving part **463**, and the second guide part **444** may be received into the second receiving part **464**.

Referring to FIG. 2, as described above, the mounting part **11** may include the first detector **550** that detects the mounting of the dust container **200** and a second detector **560** that detects a position (or movement) of the first compression member **240**. In more detail, the respective detectors **550** and **560** may detect a magnetic force of the magnetic member **435**. Since the magnetic member **435** is an object to be detected by the respective detectors **550** and **560**, the magnetic member **435** may be called a detected object. Hall sensors may be used as the detectors **550** and **560**.

The first detector **550** may be vertically disposed below the magnetic member **435** in a state in which the dust container **200** is mounted on the mounting part **11**. The second detector **560** may be spaced apart from the first detector **550**.

To effectively detect a magnetic force of the magnetic member **435**, the second detector **560** may be vertically disposed below a path of the magnetic member **435** when the magnetic member **435** is rotated. Also, when the first compression plate **242** and the second compression plate **252** are arranged in a straight line, the second detector **560** may be vertically disposed below the magnetic member **435**. Thus, the magnetic force of the magnetic member **435** may always be detected by the first detector **550** in a state in which the dust container **200** is mounted on the mounting part **11**.

On the other hand, during the rotation of the magnetic member, the magnetic force of the magnetic member **435** may be detected only when the magnetic member **435** is disposed above the second detector **560**. Therefore, the rotational position of the first compression member **240** may be confirmed.

Hereinafter, a process by which the respective guide parts are received into the respective receiving parts will be described.

Referring to FIGS. 16 to 18, when the lower cover **220** is rotated downwardly, the fixed part **450**, the first transfer part **430**, the second transfer part **440** may be rotated together with the lower cover **220**. In a state illustrated in FIG. 18, when the lower cover **220** is rotated upwardly, the insertion protrusion **452** may be inserted into the protrusion receiving part **462**.

If the respective guide parts **443** and **444** are aligned with the respective receiving parts **463** and **464**, the respective guide parts **443** and **444** may be received into the respective receiving parts **463** and **464**. On the other hand, if the respective guide parts **443** and **444** are not aligned with the respective receiving parts **463** and **464**, the respective guide parts **443** and **444** may be compressed by a bottom surface of the connection part **460**, and thus, the elastic member **470** may shrink. Therefore, the second transfer part **440** may be moved downwardly.

In this state, when the first transfer part **430** is rotated by the driving source, the second transfer part **440** may be rotated also. Further, since the respective guide parts **443** and **444** are not received into the respective receiving parts **463** and **464**, the first compression member **240** may be maintained in a stopped state.

During the rotation of the second transfer part **440**, when the respective guide parts **443** and **444** are aligned with the respective receiving parts **463** and **464**, the respective guide parts **443** and **444** may be received into the respective receiving parts **463** and **464**. As a result, the first compression member **240** may be rotated together with the second transfer part **440**.

FIG. 19 is a block diagram of a control structure of a vacuum cleaner according to the embodiment of FIG. 1. Referring to FIG. 19, the vacuum cleaner according to this embodiment may include a controller **500**, an operation signal input device **520**, a signal generator **530**, a suction motor driver **505**, a compression motor driver **405**, the first detector **550**, the second detector **560**, and a dust amount display **540**. The operation signal input device **520** may select a suction power degree (for example, strong, medium, and weak modes). The signal generator **530** may generate an empty request signal of dust stored in the dust container **200** and a dust container non-installation signal. The suction motor driver **505** may operate the suction motor **510** according to an operation mode input from the operation signal input device **520**. The compression motor driver **405** may operate the compression motor **410**. The first detector **550** may detect mounting of the dust container **200**. The second detector **560** may detect a position of the first compression member **240**. The dust amount display **540** may display an amount of dust stored in the dust container **200** to the outside.

In more detail, the compression motor **410** may be forwardly or reversely rotatable. That is, a motor that can be rotated in both directions may be used as the compression motor **410**. Thus, the first compression member **240** may be forwardly rotated (for example, in a clockwise direction) and reversely rotated (in a counter-clockwise direction). As the first compression member **240** is forwardly or reversely rotated, compressed dust may build up on both sides of the second compression member **250**.

A synchronous motor may be used as the compression motor so as to forwardly or reversely rotate the compression motor **410**. The synchronous motor may be forwardly or reversely rotated by the motor itself. In a case in which the motor is rotated in one direction, when a force having a value greater than a preset value is applied to the motor, the motor may be rotated in the other direction. The force applied to the motor represents a resistance (for example, torque) generated when the first compression member **240** compresses the dust. When the resistance reaches a preset value, the rotational direction of the motor is changed.

Since synchronous motors are generally well-known in the motor technology field, detailed description has been omitted. However, that the compression motor may be forwardly or reversely rotated by a synchronous motor is within the technical scope of this embodiment.

Even through the first compression member **240** may reach a point at which the first compression member is not rotated any longer while the first compression member **240** is rotated to compress the dust, the first compression member **240** may continuously compress the dust for a predetermined period of time. The point at which the first compression member is no longer rotated represents a case in which the resistance reaches the preset value.

When the resistance reaches the preset value, current applied to the motor significantly increases. Thus, when current variation is detected by a current detector (not shown) and the detected current variation is transmitted to the controller **500**, the controller **500** may intercept the current applied to the motor for a predetermined period of time.

Thus, the first compression member **240** may maintain a state in which the dust is compressed in a state in which the first compression member **240** is stopped. After the predetermined elapsed time in the state in which the first compression member **240** is stopped, power is applied to the compression motor **410** to rotate the first compression member **240**. The cut of timing of the power applied to the compression motor **410** is a case in which the resistance reaches the preset value. Therefore, when the compression motor **410** is operated again, the rotational direction of the compression motor **410** will be opposite to that in which the compression motor is rotated before the power is cut off. Also, the first compression member **240** may be continuously forwardly or reversely rotated at the same angular speed so that the compression motor **410** easily compresses the dust.

In case in which the dust container **200** is not mounted on the mounting part **11**, the magnetic force of the magnetic member **435** may not be detected by the first detector **550**. Thus, in this state, when an operation signal is input from the operation signal input **520**, the signal generator **530** may generate the dust container non-installation signal under the control of the controller **500**.

The controller **500** may determine an amount of dust stored in the dust container **200**, based on a position of the first compression member **240** detected by the second detector **560**. When the controller determines that an amount of dust stored in the dust container is greater than a reference amount, the signal generator may generate a dust empty request signal. To confirm a position of the first compression member **240** may be understood as that which confirms a position of the magnetic member **435**.

The signal generated from the signal generator **530** may include an aural or audible signal, a visual signal, or a vibration directly transferred to the user. For example, a speaker or a light emitting diode (LED) may be used as the signal generator **530**.

FIGS. **20** and **21** are views illustrating a positional relationship between a magnetic member and a second detector in a case in which a first compression member that compresses dust is close to one side of a second compression member.

FIGS. **22** and **23** are views illustrating a positional relationship between the magnetic member and the second detector in a case in which the first compression member and the second compression are disposed in a straight line. FIGS. **24** and **25** are views illustrating a positional relationship between the magnetic member and the second detector in a case in which the first compression member is close to the other side of the second compression member.

Referring to FIGS. **20** to **25**, when the first compression member **240** is rotated, and thus, the first compression member **240** and the second compression member **250** are disposed in a straight line, the magnetic member **435** may be vertically disposed above the second detector **560**. Thus, the second detector **560** may detect the magnetic force of the magnetic member **435**. A position of the first compression member **240** illustrated in FIG. **22**, that is, a position, at which the second detector **560** may detect the magnetic force of the magnetic member **435**, of the first compression member **240** may be referred to as a "reference position" for convenience of description.

When the first compression member **240** is rotated in a counter-clockwise direction with respect to the reference position, as illustrated in FIG. **20**, since the magnetic member **435** is spaced from the second detector **560**, the second detector **560** may not detect the magnetic force of the magnetic member **435**.

Also, when the first compression member **240** rotated in the counter-clockwise direction is no longer rotated, the first compression member **240** is then rotated in a clockwise direction. Thus, the first compression member **240** passes through the reference position illustrated in FIG. **22**, and then is rotated toward a right side of the second compression member **250**, as illustrated in FIG. **24**, to compress the dust stored in the dust container **200**. When the first compression member **240** rotated in the clockwise direction is no longer rotated, the compression motor **410** may be rotated again in the counter-clockwise direction to repeatedly perform the above-described processes, thereby compressing the dust stored in the dust container **200**.

Regarding the detection of the magnetic member **435** by the respective detectors **550** and **560**, the reason the receiving positions of the guide parts **443** and **444** are specifically defined will be described below. That is, the reason the receiving positions of the guide parts **443** and **444** are specifically defined is to constantly maintain an angle (including 0 degree) between the magnetic member **435** and the first compression plate **242**. In more detail, as described above, the reference position of the first compression member **240** may be a position in which the magnetic member **435** is vertically disposed above the second detector **560**. The reference position should be equally maintained at any moment. For equally maintaining the reference position, the magnetic member **435** and the first compression member **240** may have the same angle.

In this embodiment, the first compression member **240** may be freely rotatably coupled to the dust container **200**, and the first transfer part **430** including the magnetic member **435** may be freely rotatably coupled to the lower cover **220**. Thus, in a case in which structures (that is, the respective guide parts **443** and **444** and the respective receiving parts **463** and **464**) in which the relative position between the magnetic member **435** and the first compression member **240** is maintained are not provided, the relative position between the magnetic

member **435** and the first compression member **240** may be varied whenever the lower cover **220** is opened or closed.

Thus, in this embodiment, the respective guide parts **443** and **444** and the respective receiving parts **463** and **464** are provided. Further, the respective guide parts **443** and **444** may be received into only the respective receiving parts **463** and **464**. Therefore, in a state in which at least the first compression member **240** is rotated, the angle between the magnetic member **435** and the first compression member **240** may be constantly maintained (in this embodiment, 0 degree). Also, as the angle between the first compression member **240** and the magnetic member **435** are constantly maintained, an amount of dust may be precisely determined.

FIG. **26** is a view illustrating a rotational operation of the first compression member of FIGS. **20** to **25**. A time **TD1** required for the first compression member **240** to be rotated from the reference position in the counter-clockwise direction and then return again to the reference position, and a time **TD2** required for the first compression member **240** to be rotated from the reference position in the clockwise direction and then return again to the reference position are illustrated in FIG. **26**. For convenience of description, the time **TD1** may be referred to as a first round-trip time **TD1**, and the time **TD2** may be referred to as a second round-trip time **TD2**. Generally, since dust is uniformly distributed within the dust container **200**, the first round-trip time **TD1** may be substantially equal to the second round-trip time **TD2**.

When an amount of the dust compressed by the first compression member **240** gradually increases, the first round-trip time **TD1** and the second round-trip time **TD2** may gradually decrease. In this embodiment, when any one of the first round-trip time **TD1** and the second round-trip time **TD2** reaches a predetermined reference time, the controller may determine that the dust within the dust container **200** sufficiently builds up to allow the signal generator to generate the dust empty request signal.

FIG. **27** is a flowchart of a control method of a vacuum cleaner according to the embodiment of FIG. **1**. Referring to FIG. **27**, in a state in which an operation of the vacuum cleaner is stopped, the controller may determine whether a suction motor operation signal is input through the operation signal input device **520**, in step **S10**.

When the controller **500** determines that the suction motor operation signal is input, the controller **500** may determine whether the dust container **200** is mounted or installed on the mounting part **11**, in step **S11**. When the dust container **200** is not mounted on the mounting part **11**, the magnetic force of the magnetic member **435** may not be detected by the first detector **550**. In this case, the controller **500** may control the signal generator **530** to generate the dust container non-installation signal, in step **S12**. Then, the suction motor **510** may be maintained in a stopped state.

When the suction motor operation signal is input in a state in which the dust container **200** is not mounted, a user may easily confirm the non-installation of the dust container **200** by informing it to the outside, that is, informing a user. Also, the operation of the suction motor **510** may be stopped in the state in which the dust container **200** is not mounted to prevent the suction motor **510** from being unnecessarily operated.

On the other hand, when the magnetic force of the magnetic member **435** is detected by the first detector **550**, and thus, the controller **500** determines that the dust container **200** is mounted, the controller **500** may operate the suction motor **510** according to a suction power selected by the user, in step **S13**.

When the suction motor **510** is operated, the dust may be sucked in through the suction nozzle **20** by the suction force

generated by the suction motor **510**. The air sucked in through the suction nozzle **20** may be introduced into the main body **10**. The air introduced into the main body **10** of the vacuum cleaner may be separated from the dust in the dust separation device **100**. The dust separated from the air may be stored in the dust container **200**.

In the process in which the dust is separated from the air and the separated dust is stored in the dust container **200**, the dust stored in the dust container **200** may be compressed by interaction between the plurality of compression members **240** and **250**. That is, in step **S14**, the controller **500** may operate the compression motor **410** to compress the dust stored in the dust container **200** after the suction motor **510** is operated.

Although the compression motor **410** is operated after the suction motor **510** is operated in this embodiment, the suction motor **510** and the compression motor **410** may be operated at the same time. In step **S14**, when the compression motor **410** is operated, the main body transfer part **420** coupled to the compression motor **410** may be rotated. When the main body transfer part **420** is rotated, the first transfer part **430** engaged with the main body transfer part **420** may be rotated. When the first transfer part **430** is rotated, the second transfer part **440** may be rotated together with the first transfer part **430**.

When the second transfer part **440** is rotated, the connection part **460** connected to the second transfer part **440** may be rotated. Thus, the first compression member **240** may be rotated toward the second compression member **250** to compress the dust.

In step **S15**, the controller **500** may confirm whether the first compression member **240** is disposed at the reference position. According to this embodiment, since the first round-trip time **TD1** and the second round-trip time **TD2** are measured based on the reference position of the first compression member **240**, it may be necessary to confirm that the first compression member **240** is disposed at the reference position when the first compression member **240** is initially operated.

A time point at which the first compression member **240** is initially disposed at the reference position may be a time point at which the magnetic force of the magnetic member **435** may be initially detected by the second detector **560** during the operation of the compression motor **410**. Thus, in step **S16**, the controller **500** may measure the first round-trip time **TD1** and the second round-trip time **TD2** of the first compression member **240** based on the time point at which the magnetic force of the magnetic member **435** is initially detected by the second detector **560**. For example, the controller **500** may include a counter (not shown) that measures the respective round-trip times. As an amount of the dust compressed within the dust container **200** by the first compression member **240** and the second compression member **250** increases, a left-right round-trip rotation time of the first compression member **240** may gradually decrease.

Thus, in step **S17**, the controller **500** may determine the first round-trip time **TD1** and the second round-trip time **TD2** of the first compression member **240**, and may also determine whether the first round-trip time **TD1** or the second round-trip time **TD2** reaches the reference time. The reference time may be a time set in the controller **500** by a designer or user. Thus, the reference time may be a base for determining that the dust builds up within the dust container **200**. Since the reference time is obtained by repeatedly performing an experiment by the designer, a capacity of the dust container may be varied.

In this embodiment, when any one of the first round-trip time **TD1** and the second round-trip time **TD2** reaches the reference time (or less than the reference time), it may be

determined that an amount of the dust reaches a predetermined amount (dust empty required amount). Or, when all of the first round-trip time TD1 and the second round-trip time TD2 reach the reference time, it may be determined that an amount of the dust reaches a predetermined amount (dust empty required amount).

According to the determined results in step S17, when any one of the first round-trip time TD1 and the second round-trip time TD2 is greater than the reference time, the process may return to step S16 to perform again step S16. On the other hand, when the first round-trip time TD1 or the second round-trip time TD2 reaches the reference time, the controller 500 may control the signal generator 530 to generate the dust empty required signal in step S18.

In step S19, the controller 500 may turn off the suction motor 510 to prevent the dust from being sucked. If the dust is forcibly sucked in a state in which an amount of the dust builds up within the dust container 200 exceeds a predetermined amount, suction efficiency may be reduced, and the suction motor 510 may be overloaded. Thus, in this embodiment, the suction motor 510 may be stopped. In step S20, the controller 500 may turn off the compression motor 410. The suction motor 510 and the compression motor 410 may be turned off one after the other or at the same time.

According to this embodiment, since the dust stored in the dust container 200 may be compressed by the interaction between the first compression member 240 and the second compression member 250, an amount of the dust stored in the dust container 200 may be maximized. Also, the dust container non-installation signal may be utilized to prevent the suction motor 510 and the compression motor 410 from being unnecessarily operated. Also, when an amount of the dust stored in the dust container 200 reaches a predetermined amount, the dust empty required signal may be utilized to allow the user to easily confirm a dust empty required time, thereby improving user convenience.

In addition to the above-described descriptions, this embodiment may further include the following. When a state in which the suction motor is stopped and the dust container is not mounted on the main body of the vacuum cleaner, the suction motor may be maintained in the stopped state, even through the suction motor operation signal is input. Alternatively, when the suction motor operation signal is input, the suction motor may be stopped after it is operated for a predetermined period of time. In this case, the user may more easily confirm the dust container non-installation through the operation stop of the suction motor.

Also, in case in which an amount of the dust exceeds the predetermined amount, when an operation of the suction motor is stopped, an operation of the compression motor may not be stopped. That is, when the operation of the suction motor is stopped, the operation of the compression motor may be stopped after the first compression member is moved to a side of the second compression member, so that the dust disposed between the first compression member and the side of the second compression member may be compressed.

Although a plurality of guide parts and receiving parts may be provided in this embodiment, one guide part and one receiving part may be sufficient, and thus, provided. Also, although the respective guide parts may be disposed on the second transfer part and the respective receiving parts may be disposed in the connection part in this embodiment, the respective receiving parts may be disposed in the second transfer part and the respective guide parts disposed on the connection part. Further, although the connection part may be coupled to the rotation shaft in this embodiment, the connection part may be integrated with the rotation shaft. However,

in this case, the coupling boss 256 may protrude from the rotation shaft, the insertion part 245, in which the coupling boss 256 may be inserted, may be disposed in the fixed shaft 254, and the coupling member 480 may be inserted, into the coupling boss 256 from an upper side of the fixed shaft 254.

FIG. 28 is a perspective view of a dust separator according to another embodiment. FIG. 29 is a sectional view taken along line XXIX-XXIX of FIG. 28. FIG. 30 is a sectional view taken along line XXIX-XXIX of FIG. 28 in a state in which a coupling between a coupling member and a dust separation device is released.

Referring to FIGS. 28 to 30, a dust separator 700 according to this embodiment may include a dust separation device 900, a dust container 1000, and an exhaust guide device 800. The dust separation device 900 may separate dust from sucked air. The dust container 1000 may store the dust separated by the dust separation device 900. The exhaust guide device 800 may guide exhaust of the air separated by the dust separation device 900.

In this embodiment, since a structure of the exhaust guide device 800 is the same as that described with respect to the embodiment of FIG. 1, repetitive description has been omitted. Further, since a structure of the dust separation device of this embodiment is the same as that of the embodiment of FIG. 1 except for a coupling structure of a filter device, repetitive description of the dust separation device except for the filter device has been omitted.

The dust separation device 900 may include a plurality of filter devices 920. The plurality of filter devices 920 may be rotatably coupled to the dust separation device 900 to filter air in which a dust separation process is performed within the dust separation device 900.

In more detail, each of the filter devices 920 may include a filter member 940 selectively inserted into the dust separation device 900 and a cover member 930 coupled to the filter member 940. The filter member 940 may include the flow guide (see reference numeral 145 of FIG. 13) described with respect to the embodiment of FIG. 1.

A hinge part 932 may be disposed on the cover member 930. A hinge coupling part 904, to which the hinge part 932 may be coupled, may be integrated to the outside of the dust separation device 900.

The cover member 930 may include a coupling member 950 selectively coupled to the dust separation device 900. In more detail, the coupling member 950 may be rotatably coupled to the outside of the cover member 930. A receiving part 933 configured to receive the coupling member 950 may be recessively disposed in the cover member 930. An elastic member 960 that elastically supports the coupling member 950 may be disposed in the receiving part 933.

An opening 934, through which a hook 952 of the coupling member 950 may pass, may be defined in the cover member 930. A hook hanger 902 that selectively hooks the hook 952 may be disposed in the dust separation device 900.

Referring to FIG. 29, to withdraw the filter member 940 to the outside of the dust separation device 900, a user may operate the coupling member 950, as illustrated in FIG. 30. As a result, the elastic member 960 may be compressed to release the hooking effect between the hook 952 of the coupling member 950 and the hook hanger 902. Thus, the cover member 930 coupled to the filter member 940 may be rotatable with respect to the dust separation device 900. Then, when the cover member 930 is rotated, the filter member 940 disposed within the dust separation device 900 may be withdrawn to the outside. In a state in which the filter member 940 is

withdrawn to the outside of the dust separation device **900**, the user may clean the filter member **940** or the inside of the dust separation device **900**.

FIG. **31** is a sectional view taken along line XXXI-XXXI of FIG. **28**. FIG. **32** is a perspective view of a dust container in a state in which a lower cover is open. FIG. **33** is a perspective view illustrating a main body of a vacuum cleaner according to the another embodiment.

Referring to FIGS. **31** to **33**, the dust container **1000** according to this embodiment may include a dust collector body **1010** in which a chamber that stores dust may be disposed and a lower cover **1020** that covers a lower portion of the dust collector body **1010**. The dust collector body **1010**, for example, may have a cylindrical shape and an open lower side; however, embodiments are not limited thereto.

Similar to the embodiment of FIG. **1**, the lower cover **1020** may be rotatably coupled to the dust collector body **1010** by a hinge. Also, a protrusion part **1022** may be disposed at a central portion of the lower cover **1020**.

The dust collector body **1010** may include a plurality of compression members **1030** and **1040** that compress the dust stored in the dust collector body **1010**. The plurality of compression members **1030** and **1040** may include a first compression member **1030** movably disposed within the dust collector body **1010** and a second compression member **1040** fixed to an inner circumference surface of the dust collector body **1010**. For example, the first compression member **1030** may be rotatably disposed within the dust collector body **1010**, and the second compression member **1030** may be integrated with an inner circumferential surface of the dust collector body **1010**.

In more detail, the first compression member **1030** may include a rotation shaft **1034** and a first compression plate **1032** integrated with the rotation shaft **1034** to compress the dust. A cleaning member **1037** for cleaning the inner circumferential surface of the dust collector body **1010** may be coupled to a lateral surface of the first compression plate **1032**. The cleaning member **1037** may be slidably vertically coupled to a lateral portion of the first compression plate **1032** or may be integrated with a lateral portion of the first compression plate **1032** by, for example, inserted-injection molding. In a case in which the cleaning member **1037** is slidably coupled to the first compression plate **1032**, a coupling part coupled to a portion of the cleaning member **1037** may be disposed on the lateral portion of the first compression plate **1032**.

For example, the cleaning member **1037** may be formed of, for example, a rubber material. The cleaning member **1037** may contact the inner circumferential surface of the dust collector body **1010**. When the first compression member **1030** is rotated, the cleaning member **1037** may be rotated in a state in which it contacts the inner circumferential surface of the dust collector body **1010** to brush the dust (specifically, fine dust) on the inner circumferential surface of the dust collector body **1010**.

Thus, since the inner circumferential surface of the dust collector body **1010** is cleaned, a user may easily confirm an amount of the dust stored in the dust collector body **1010** from the outside. To confirm an amount of the dust stored in the dust collector body **1010** from the outside, the dust collector body **1010** may be formed of, for example, a transparent material.

The second compression member **1040** may include a second compression plate **1042** that compresses the dust by an interaction between the second compression member **1040** and the first compression plate **1032**. A fixed shaft **1044**, to which the rotation shaft **1034** may be coupled, may be dis-

posed on an upper wall of the dust collector body **1010**. The fixed shaft **1044** may extend downwardly from an upper wall of the dust collector body **1044**. The second compression plate **1042** may be integrated with the fixed shaft **1044**.

Portions of lower portions of the first compression plate **1032** and the second compression plate **1042** may be cut to prevent the first and second compression plates **1032** and **1042** from interfering with the protrusion part **1022**. Thus, the lower portions of the first and second compression plates **1032** and **1042** may be disposed between the protrusion part **1022** and the inner circumferential surface of the dust collector body **1010**.

A coupling shaft **1035** coupled to the fixed shaft **1044** may be disposed within the rotation shaft **1034**. A coupling boss **1046**, in which the coupling shaft **1035** may be inserted, may be disposed on the fixed shaft **1044**. The coupling shaft **1035** may be inserted into the coupling boss **1046** from a downward direction of the fixed shaft **1044**. Also, a coupling member **1036** may be coupled to the coupling shaft **1035** from the outside of the dust collector body **1010** in a state in which the coupling shaft **1035** is inserted into the coupling boss **1046**.

Since a principle by which the dust is compressed by the first compression plate **1032** and the second compression plate **1042** is the same as that of the embodiment of FIG. **1**, repetitive description has been omitted. The first compression member **1030** may be automatically moved by a driving device. The driving device may include a driving source that drives the first compression member **1030** and a power transmission device that transmits a power of the driving source to the first compression member **1030**.

For example, the compression motor (see reference numeral **410** of FIG. **19**) may be used as the driving source. As characteristics and operations of the compression motor (see reference numeral **410** of FIG. **19**) were described with reference to the embodiment of FIG. **1**, repetitive description has been omitted. The compression motor (see reference numeral **410** of FIG. **19**) may be disposed below the protrusion part **1022**.

The power transmission device may include a main body transfer part **1120** coupled to the compression motor (see reference numeral **410** of FIG. **19**) and disposed in a cleaner main body **1200** and a transfer device selectively connected to the main body transfer part **1120**.

The transfer device may include a first transfer part **1130**, a second transfer part **1140**, and a connection part **1150**. The first transfer part **1130** may be disposed below the protrusion part **1022**. The second transfer part **1140** may be disposed above the protrusion part **1022** and coupled to the first transfer part **1130**. The connection part **1150** may be selectively connected to the second transfer part **1140**.

For example, a gear may be utilized as each of the main body transfer part **1120** and the first transfer part **1130**. When the dust separator **700** is mounted on the cleaner main body **1200**, the first transfer part **1130** may be engaged with the main body transfer part **1120**.

The first transfer part **1130** and the second transfer part **1140** may be coupled to each other by a coupling member **1142**. Thus, when the first transfer part **1130** is rotated, the second transfer part **1140** may be rotated as well.

The connection part **1150** may be integrated with a lower portion of the rotation shaft **1034**. On the other hand, the connection part **1150** may be provided separate from the rotation shaft **1032** and coupled to the lower portion of the rotation shaft **1034**.

When the lower cover **1020** closes a lower side of the dust collector body **1010**, the second transfer part **1140** may be disposed inside the dust collector body **1010** and connected to

the connection part 1150. When the lower cover 1020 opens the lower side of the dust collector body 1010, the connection between the connection part 1150 and the second transfer part 1140 may be released.

In this embodiment, for example, a plurality of uneven parts engaged with each other may be disposed on each of contact surfaces between the second transfer part 1140 and the connection part 1150. That is, in this embodiment, a clutch structure may be utilized for the second transfer part 1140 and the connection part 1150, as an example.

However, the connection structure between the second transfer part 1140 and the connection part 1150 is not limited to the above-described structure. For example, the second transfer part 1140 and the connection part 1150 may be selectively connected to each other using various methods. Thus, according to the spirit of this embodiment, provided are a first guide part having various structures and disposed on the second transfer part 1140, and a second guide part having various structures disposed on the connection part 1150 and selectively coupled to the first guide part.

Referring to FIG. 33, a mounting part 1210 on which the dust separator 700 may be mounted, may be disposed in the main body 1200. The mounting part 1210 may have a shape corresponding to that of the protrusion part 1022. A mounting guide 1220, which may be inserted into the protrusion part 1022, may be disposed on the mounting part 1210. The mounting guide 1220 may protrude upwardly from a bottom surface of the mounting part 1210.

The main body transfer part 1120 may be disposed on the mounting guide 1220. A portion of the main body transfer part 1120 may be disposed within the main body 1200, the other portion of the main body transfer part 1120 may pass through the main body 1200 and be exposed to the mounting part 1210.

Also, a mounting detection part that detects the mounting of the dust container (or the dust separator) may be disposed on the mounting guide 1220. For example, a micro switch 1160 may be utilized for the mounting detection part. The micro switch 1160 may include a lever 1162 that turns on/off the micro switch 1160.

The micro switch 1160 may be disposed inside the main body 1200. A portion of the lever 1162 may be exposed to the outside of the mounting guide 1220. When the dust separator 700 is mounted on the mounting part 1210, the lever 1160 may be rotated to compress a contact point 1164 of the micro switch 1160, thereby turning on the micro switch 1160. Then, an ON signal of the micro switch 1160 may be transmitted to a controller (not shown), and the controller may detect that the dust separator 700 is mounted on the cleaner main body 1200.

On the other hand, when the dust separator 700 is separated from the mounting part 1210, since the lever 1162 compressing the contact point 1164 of the micro switch 1160 is spaced from the contact point 1164, the micro switch 1160 may be turned off. Then, an OFF signal of the micro switch may be transmitted to the controller (not shown), and the controller may detect that the dust separator 700 is separated from the dust main body 1200.

When a suction motor operation signal is input in a state in which the dust separator 700 is not mounted, a dust separator non-installation signal may be generated by a signal generator (not shown). Also, when the dust separator is separated from the main body in a state in which the dust separator is mounted and the suction motor is operated, the dust separator non-installation signal may be generated in the signal generator.

FIG. 34 is a sectional view taken along line XXXIV-XXXIV of FIG. 33. Referring to FIGS. 33 and 34, a cord reel

1300, around which a power cord that supplies power to the cleaner main body 1200 may be wound, may be disposed within the main body 1200. A cord reel chamber 1230, in which the cord reel 1300 may be received, may be disposed inside the mounting part 1210. The cord reel chamber 1230 may be disposed below the protrusion part 1220. A cord reel lever 1310, by which the loose power cord may be wound by a user's operation, may be disposed at a rear side of the main body 1200. For this embodiment, since a well-known component may be used as the cord reel 1300, detailed description with respect to a structure of the cord reel 1300 has been omitted.

An exhaust filter device 1400 that filters air passing through a suction motor 1320 may be disposed below the cord reel 1300. A filter device chamber 1250 configured to receive the exhaust filter device 1400 may be disposed in the main body 1200. A front surface of the main body 1200 may be depressed backwardly to form the filter device chamber 1250. The exhaust filter device 1400 may be selectively received into the filter device chamber 1250 at a front side of the main body 1200.

A suction motor 1320 that generates a suction force may be disposed below the exhaust filter device 1400. The suction motor 1320 may be received into a motor chamber 1240 disposed below the filter device chamber 1250.

Thus, the cord reel 1300 may be disposed below the dust separator 700 in a state in which the dust separator 700 is mounted on the main body 1200. The exhaust filter device 1400 may be disposed below the cord reel 1300. The suction motor 1320 may be disposed below the exhaust filter device 1400.

The cord reel chamber 1230 and the filter device chamber 1250 may be connected to one another by a connection passage 1260. The motor chamber 1240 and the filter device chamber 1250 may communicate with each other through an exhaust passage 1270. Thus, air exhausted from the dust separator 700 may flow into the cleaner main body 1200, and then pass through the suction motor 1320. The air passing through the suction motor 1320 may be moved to the filter device chamber 1250 through the exhaust passage 1270. The air moved to the filter device chamber 1250 may be filtered while passing through the exhaust filter device 1400. A portion of the filtered air may be exhausted to the outside of the main body 1200, and the other portion of the filtered air may be moved to the cord reel chamber 1230 through the connection passage 1260.

As described above, since the cord reel 1300 may be disposed inside the vacuum cleaner main body, the power cord may not be exposed to the outside when the main body is stored, thereby improving an outer appearance of the vacuum cleaner. Also, since a portion of the air passing through the exhaust filter device 1400 may be moved to the cord reel chamber 1230 to cool the cord reel 1300, it may prevent the cord reel from increasing in temperature. Additionally, as the cord reel chamber 1230 is disposed directly above the exhaust filter device 1400, a passage of the air for cooling the cord reel 1300 may be short, and also, the structure may be simplified.

FIG. 35 is a perspective view of an exhaust filter device according to another embodiment. FIG. 36 is a perspective view of the exhaust filter device of FIG. 35. FIGS. 37 and 38 are views illustrating a mounting structure of the exhaust filter device of FIG. 35. FIG. 37 illustrates a state in which a filter lever is hooked on the vacuum cleaner main body, and FIG. 38 illustrates a state in which the hooking of the filter lever is released.

Referring to FIGS. 35 and 38, the exhaust filter device 1400 filters the air exhausted to the outside of the main body 1200.

25

The exhaust filter device **1400** may include a filter body **1420** that protects a filter **1426** and a filter housing **1410**, in which the filter body **1420** may be received. The filter housing **1410** may include an outer wall **1411** that defines a space **1412** in which the filter body **1420** may be received.

A cover part **1413** may be disposed at a front side of the outer wall **1411**. The cover part **1413** may cover a front surface of the filter body **1420** and may be exposed to an outer surface of the main body **1200** in a state in which the exhaust filter device **1400** is mounted on the filter device chamber **1250**. That is, the cover part **1413** may define a portion of the outer appearance of the front surface of the main body **1200**.

A plurality of exhaust holes **1414**, through which air may pass, may be defined in the cover part **1413**. The filter lever **1430**, which may be configured to allow the exhaust filter device **1400** to be selectively coupled to an inner wall of the filter device chamber **1250**, may be rotatably coupled to a central portion of the cover part **1413**. An elastic member **1440** that elastically supports the filter lever **1430** may be disposed below the filter lever **1430**. The elastic member **1440** may support a lower portion of the filter lever **1430** in a state in which the elastic member **1440** is seated on the cover part **1413**.

The filter body **1420** may have a top surface **1421**, an inner wall **1423**, and an outer wall **1424**. A plurality of holes **1422**, through which air may pass, may be defined in the top surface **1421**. The inner wall **1423** may extend downwardly from an under surface of the top surface **1421** to surround the filter **1426**. The outer wall **1424** may surround the inner wall **1423** in a state in which the outer wall **1424** is spaced from the inner wall **1423**.

The filter body **1420** may be seated on the filter housing **1410**. When the filter body **1420** is seated on the filter housing **1410**, the outer wall **1411** of the filter housing **1410** may be disposed between the inner wall **1423** and the outer wall **1424** of the filter body **1420**.

A plurality of guide ribs **1425** may be disposed on both sides of the top surface **1421** to guide the air passing through the holes **1422** toward the cover part **1413** and prevent the air from laterally leaking. The plurality of guide ribs **1425** may extend in front and rear directions of the exhaust filter device **1400**.

Referring to FIGS. **37** and **38**, a hook hanger **1252**, on which a hook **1423** of the filter lever **1430** may be hooked, may be disposed on the inner wall of the filter device chamber **1250**. A portion of the inner wall of the filter device chamber **1250** may be depressed upwardly to form the hook hanger **1252**.

Referring to FIG. **37**, to separate the exhaust filter device **1400** from the main body **1200**, a front portion of the filter lever may be grasped to lift the filter lever **1430**. Thus, the filter lever **1430** may be rotated, as illustrated in FIG. **38**, and the hook **1432** may be separated from the hook hanger **1252**. As a result, the exhaust filter device **1400** may be separated from the filter device chamber **1250**.

Thereafter, the filter lever may be pull forwardly. Thus, the exhaust filter device **1400** may be separated from the filter device chamber **1250**.

According to this embodiment, as the filter housing **1410** and filter body **1420** may be separated from the main body **1200**, the exhaust filter device **1400** may be easily separated. That is, as the filter housing **1410** and the filter body **1420** may be separated from the main body **1200** by pulling the filter lever **1430** in a state in which the filter lever **1430** is rotated, the separation process may be reduced to improve a user's convenience.

26

Any reference in this specification to “one embodiment,” “an embodiment,” “example embodiment,” etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

What is claimed is:

1. A vacuum cleaner, comprising:

a main body;
a suction nozzle in communication with the main body, that sucks air into the main body;
a dust separator removably coupled to the main body, the dust separator separating dust from the air sucked into the main body by the suction nozzle and comprising:
a dust separation device including a first dust separator body, a second dust separator body formed as a separate component to the first dust separator body, and an exhaust member formed as a separate component to the first dust separator body and the second dust separator body, wherein the dust separation device generates a cyclone airflow, wherein the first dust separator body comprises a first suction opening and a first exhaust opening and the second dust separator body comprises a second suction opening and a second exhaust opening, wherein the second dust separator body is coupled to the first dust separator body in a direction parallel to a central axis of the cyclone airflow to form a singular dust separation chamber, wherein the exhaust member covers the first suction opening and the second suction opening and defines a suction passage, and wherein air flowing through the suction passage passes through the first and second suction openings.

2. The vacuum cleaner of claim 1, wherein the first dust separator body comprises a first cyclone body that generates a first cyclone flow and a first distribution body that guides air to the first cyclone body, and wherein the second dust separator body comprises a second cyclone body that generates a second cyclone flow and a second distribution body that guides air to the second cyclone body.

3. The vacuum cleaner of claim 2, wherein the first distribution body is integrated with the first cyclone body, and wherein the second distribution body is integrated with the second cyclone body.

4. The vacuum cleaner of claim 2, wherein each of the first and second cyclone bodies comprises an air suction part.

5. The vacuum cleaner of claim 2, wherein each cyclone body further comprises a suction guide that defines a lateral surface of the suction passage.

27

6. The vacuum cleaner of claim 5, wherein the exhaust member is coupled to an upper portion of the dust separation device.

7. The vacuum cleaner of claim 2, wherein each of the first and second cyclone bodies comprises a dust discharge port, and wherein when the first and second cyclone bodies are coupled together the dust discharge ports are coupled together to form a singular dust discharge passage.

8. The vacuum cleaner of claim 2, wherein at least one of the first distribution body or the second distribution body comprises a suction hole.

9. The vacuum cleaner of claim 8, wherein each of the first and second distribution bodies comprises a flow guide that guides air sucked in through the suction hole, such that the air flows toward the respective suction opening of the respective dust separator body.

10. The vacuum cleaner of claim 9, wherein each of the first and second cyclone bodies further comprises an exhaust guide that guides air exhausted through the exhaust opening.

11. The vacuum cleaner of claim 10, wherein the exhaust member comprises a plurality of exhaust passages and a plurality of passage formation parts, each of the plurality of passage formation parts comprising a middle portion, a first guide portion disposed at a rear side of the middle portion with respect to an air suction direction, and a second guide portion disposed at a front side of the middle portion with respect to an air suction direction, and wherein air flows sequentially along the second guide portion, the middle portion, and the first guide portion to be introduced into the cyclone chamber through the respective first or second suction opening.

28

12. The vacuum cleaner of claim 11, wherein the flow guide of the respective distribution body and an outer surface of the respective cyclone body form a connection passage along which air flows from the suction hole to the passage formation parts and the suction opening.

13. The vacuum cleaner of claim 1, further comprising a plurality of filter devices coupled, respectively, to the dust separator bodies.

14. The vacuum cleaner of claim 13, wherein each of the plurality of filter devices comprises:

a cover member rotatably attached to a respective dust separator body; and

a filter member coupled to the cover member.

15. The vacuum cleaner of claim 14, wherein each of the first and second dust separator bodies comprises a coupling part configured to be coupled to a coupling member of a respective cover member.

16. The vacuum cleaner of claim 1, wherein the first dust separator body has a first coupling surface and the second dust separator body has a second coupling surface, and wherein the first coupling surface and the second coupling surface are coupled to each other.

17. The vacuum cleaner of claim 16, further comprising a seating provided on at least one of the first coupling surface or the second coupling surface configured to seat a sealer therein.

18. The vacuum cleaner of claim 1, wherein the vacuum cleaner comprises an upright type vacuum cleaner.

* * * * *